A COOPERATIVE VENTURE CAPITAL FRAMEWORK

AN INNOVATION PIPELINE DEVELOPED WITH AN ENTERPRISE ENGINEERING APPROACH THAT SUPPORTS AND PROMOTES ENTREPRENEURIAL TEAMS IN COMMERCIALISING INTELLECTUAL PROPERTY AND TECHNOLOGY

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Thesis

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DECLARATION

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ABSTRACT

The field of entrepreneurship and innovation has been prominent in the past century, with increasingly more research produced in recent decades. The identified interdependencies between entrepreneurship and innovation are essential for developing a competitive advantage to all organisations and regions, but require enablers to succeed in effectively utilising them for socio-economic development and impact.

The problem identified in the literature is the challenge found in commercialising intellectual property or technology. It is evident that both internal and external detriments influence the process and success of commercialisation. Therefore, the need for an innovation pipeline to support and promote entrepreneurship and innovation is crucial for attaining the benefits from socio-economic development. The research argument is rooted in the constructivism theory whereby the accumulation and reconstruction of knowledge and the research method uses a systems engineering approach to guide the research argument. The complex problem was defined after reviewing the literature, which then disseminated the complex problem into unit problems. In reviewing the literature, unit solutions were identified for the unit problems and formulated into design criteria for the holistic conceptual framework.

The Cooperative Venture Capital Framework (CVCF) developed from the design criteria provides a suitable conceptual solution to developing an innovation pipeline through fundamentally enabling entrepreneurship with a comprehensive support structure. The CVCF considers the strategic positioning to optimally provide sufficient support in a given environment while enabling entrepreneurship through providing funding and support services essential for overcoming commercialising challenges. The CVCF considers the value proposition for investors, partnerships and entrepreneurial teams to mutually benefit in collaboration.

The inclusive solution developed is verified as an authentic and trustworthy best practice from the literature review. Using an enterprise engineering methodology, the output of the CVCF is further verified by the enterprise engineering structural components. The CVCF was then validated by structured interviews with thirteen entrepreneurs, innovators and business developers to confirm the results from the literature review, while the application of the CVCF using a case study example was validated with five semi-structured interviews with business developers, managers, and executives. The feedback was then used to adjust the framework accordingly and it was found that the CVCF provides a comprehensive and inclusive solution and has created a new paradigm in the application of entrepreneurship and innovation.

The significance of this research study is the holistic conceptual framework developed that utilises and combines cooperative and venture capital models with multiple other solutions interdependently enabling the creation of a new paradigm in thinking. This is crucial in addressing the complex problem of commercialising intellectual property or technology for a socio-economic impact. Other significant aspects also include the lean growth and enterprise engineering methodology created.

OPSOMMING

Entrepreneurskap en innovasie vervul die afgelope eeu ’n kernrol, en navorsing het in die onlangse dekades aansienlik toegeneem. Die bewese verband tussen entrepreneurskap en innovasie is noodsaaklik vir die ontwikkeling van ’n mededingende voordeel vir alle organisasies en streke. Tog is sekere instaatstellers nodig om entrepreneurskap en innovasie werklik doeltreffend te benut om sosio-ekonomiese ontwikkeling teweeg te bring en ’n impak te hê.

Die probleem waarop die literatuur dui, is die uitdagings verbonde aan die kommersialisering van intellektuele eiendom of tegnologie. Sowel interne as eksterne faktore blyk die proses en sukses van kommersialisering te beïnvloed. Daarom is ’n innovasiepyplyn ter ondersteuning en bevordering van entrepreneurskap en innovasie van die allergrootste belang om sosio-ekonomiese ontwikkelingsvoordele tot gevolg te hê. Die navorsingsargument is gegrond op die teorie van konstruktivisme, waarvolgens kennis versamel en gerekonstrueer word, en word gerig deur ’n stelselsingenieurswesebenadering as navorsingsmetode. ’n Komplekse probleem word na aanleiding van ’n literatuuroorsig uitgewys en daarna in eenheidsprobleme verdeel. Op grond van die literatuur word eenheidsoplossings dan vir die eenheidsprobleme gevind en in ontwerpkriteria vir die holistiese konseptuele raamwerk omskep.

Die koöperatiewe waagkapitaalraamwerk (“CVCF”) wat uit die ontwerpkriteria ontstaan, bied ’n gepaste konseptuele oplossing vir die ontwikkeling van ’n innovasiepyplyn deur ’n fundamentele en omvattende steunstruktuur vir entrepreneurskap te skep. Die CVCF neem in ag watter strategiese posisionering optimale steun in ’n bepaalde omgewing sal bied, en dien terselfdertyd as instaatsteller vir entrepreneurskap deur noodsaaklike finansiering en steundienste te voorsien om kommersialiseringsuitdagings te bowe te kom. Boonop hou die CVCF rekening met die waardevoorstel sodat beleggers, vennootskappe en entrepreneurspanne wedersydse voordele uit die samewerking kan put.

Die inklusiewe oplossing wat die navorsing voorstel, word aan die hand van beste praktyke in die literatuur as outentiek en betroubaar bevestig. Daarbenewens word die uitset van die CVCF ook op grond van die strukturele komponente van ondernemingsingenieurswese geverifieer. Hierna word die CVCF deur middel van gestruktureerde onderhoude met 13 entrepreneurs, innoveerders en sakeontwikkelaars gestaaf om die resultate van die literatuuroorsig te bevestig. Die toepassing van die CVCF met behulp van ’n gevallestudievoorbeeld word op sy beurt met vyf semigestruktureerde onderhoude met sakeontwikkelaars en bestuurders gestaaf. Ná die nodige aanpassings aan die raamwerk op grond van deelnemerterugvoer word daar bevind dat die CVCF ’n omvattende en inklusiewe oplossing bied en ’n nuwe paradigma skep vir die toepassing van entrepeneurskap en innovasie.

Hierdie navorsingstudie lewer ’n beduidende bydrae deur ’n holistiese konseptuele raamwerk te ontwikkel wat koöperatiewe en waagkapitaalmodelle in kombinasie met verskeie ander oplossings gebruik om ’n nuwe denkwyse te skep. Dít dien as oplossing vir die komplekse probleem van die kommersialisering van intellektuele eiendom of tegnologie vir sosio-ekonomiese impak. Ander belangrike bydraes sluit in die metodologie van soepel groei en ondernemingsingenieurswese wat in die loop van die navorsing geskep word.

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1 The Research Journey

This is the start of the research journey. It includes a preliminary literature review defining the research purpose and scope. This was used to formulate the research methodology that includes the research problem; research questions and objectives; the research delimitation and limitation; and lastly it describes the document outline.

1.1. INTRODUCTION

In today's rapidly and ever-changing world, innovation and strategy play an essential role in sustaining a competitive advantage for any organisation. Researchers and industry extensively recognise innovation and strategic management as imperative enablers for a competitive advantage, survival necessity and growth (Schuler & Jackson, 1987; EU European Commission, 2004; Coakes & Smith, 2007; Drucker, 2007; Kennon, 2010, Teece, 2010).

However, *why do some businesses succeed in taking innovative products, services or process to market while others fail dismally?* An annual innovation survey by the Boston Consulting Group (2010) concluded that research and development spending on ideas had increased, but not all ideas are successful. The problem lies with taking prototypes, inventions and intellectual property generated, successfully into the market for commercialisation (Loof & Heshmati, 2002; Kemp et al., 2003; Van der Panne et al., 2003; Slater & Mohr, 2006).

This research study proposes an alternative solution to supporting and promoting entrepreneurship and innovation that ultimately fosters socio-economic development. The key focus is on supporting and driving the commercialisation process of intellectual property and technology of an organisation.

1.2. PRELIMINARY LITERATURE REVIEW

This research study aims to do an extensive study on multiple domains involving entrepreneurship and innovation to seek best practice models from literature to support an alternative solution to supporting commercialisation. In a preliminary literature review, innovation ecosystems, innovation models, venture capital models, strategy and growth models, cooperative models and knowledge management models were identified as viable domains supporting entrepreneurship, innovation and socio-economic development. The preliminary literature review's goal is to establish the research objectives and questions for this research study.

1.2.1. INNOVATION ECOSYSTEMS

In literature, numerous models attempt to explain the complex subject of macroeconomics and the best routes to develop the economy. The innovation ecosystem is said to specifically develop an economy through combining knowledge and commercial capital to produce innovation (Etzkowitz & Leydesdorff, 2000; Jackson, 2011; Visser, 2011), while Wang (2009) argues the supply and demand for innovation between networks and communities. The importance is that innovation ecosystems play a vital role in developing a country's economy through entrepreneurship and innovation.

The Global Innovation Index (2013) provides a framework in further defining and measuring an innovation ecosystem through indicating a country's innovation input (production of innovation), innovation output (commercialisation of innovation) and innovation efficiency (innovation input over innovation output) (Cornell University, INSEAD and WIPO, 2013). The innovation efficiency specifically relates to the innovation value chain of the country and addressing the '*valleys of death*' (gaps) (Bendis & Byler, 2009; Jackson, 2011).

In analysing innovation ecosystems in more depth, it is found that universities and technology transfer offices of universities play a prominent role in producing innovation input and transferring the intellectual property to the private sector and social market (Debackere & Veugelers, 2005; NMMU, 2010). However, the concept of traditional universities and technology transfer offices has come under question, while new thinkings have moved towards entrepreneurial universities (OECD, 2012), entrepreneurial ecosystems (Isenberg, 2012; Vogel, 2013) and start-up ecosystems (Herrmann *et al.,* 2013; PricewaterhouseCoopers, 2013).

The key essence would be to evaluate the dynamics of the different models mentioned above and the numerous challenges that inhibit the commercialisation process. The aim of the literature review on innovation ecosystems will be to identify the best practice models in order to develop appropriate alternative solutions.

1.2.2. INNOVATION MODELS

In literature, an extensive number of innovation models exist (Trott, 2005; Tidd & Bessant, 2009; Du Preez *et al*., 2013) that consider microeconomics and the impact on the business itself. But why does innovation matter? There is also a lack of consensus on the definition of innovation and all the different types of innovation that exist.

In evaluating the various innovation models, it is essential to understand that different models also usually cater for different innovation types, while critical focus in this research study is aimed at finding the balance between product and process innovation. This balance can be achieved through considering the innovation value chain or life cycles of products or services (Abernathy & Utterback, 1972; Tidd & Bessant, 2009).

When considering the historical evolution of innovation models (Du Preez, et al., 2013), innovation models have evolved from linear, sequential processes to extended and integrated innovation network models. The aim of the literature review on innovation models will be to identify best practice approaches, types and models in order to develop appropriate alternative solutions.

1.2.3. VENTURE CAPITAL MODELS

In general, venture capital (VC) supports the economy from a macroeconomic perspective by creating employment opportunities, industry competition and sophistication, etc. (Su, 2011). The extensive literature on VC covers the macroeconomic perspectives, as well as investment and portfolio strategies.

The economic benefits are due to the role of venture capital in financing entrepreneurial businesses. It was found to increase collaboration activity, as well as the probability of businesses growing towards initial public offer (Hsu, 2006). It can be accredited to the value created in developing an exit strategy and scaling proportionately in all business dimensions (Van Zyl *et al.,* 2013) while entrepreneurs leverage their networks and expertise.

The issues with the literature on VCs is that limited research exists on the typical organisational structure and innovation process. It includes the evolution of the venture capital model since its inception in the 1930s

(Griffith, 2013; Rao & Scaruffi, 2013). Essentially the aim of this research study is to evaluate the VC organisational structure and innovation process as best practice compared with other innovation and entrepreneurship models in the literature.

1.2.4. START-UP BUSINESS STRATEGY AND GROWTH MODELS

The process of commercialising intellectual property or technology is in successfully taking the intellectual property or technology to market. However, for either large organisations or start-up businesses, there is an iterative process to validate the start-up business or new product development hypothesis as to whether it will succeed or fail in the market (Ries, 2011). In large organisations, new product development failure is easily mitigated through diversifying with the portfolio effect, while with start-up businesses scarce resources limit this luxury (Eisenmann, et al., 2012).

The limited focus of innovation, strategy and growth models on entrepreneurship and small businesses is due to the tendency of these models to be geared towards larger corporations. This is despite the unique role of entrepreneurial and small businesses in developing the economy through creating employment, increasing exports, generating higher production volumes, introducing innovation and entrepreneurial skills, GDP contribution and poverty alleviation (Kirchhoff, 1994; Ayyagari *et al.,* 2003; Wiklund, 2003; Pasanen, 2006; Underhill Corporate Solutions, 2011; and Herrington *et al*., 2011).

However, the role and difference between small businesses and entrepreneurial start-up businesses is their economic impact as not all small businesses are start-up businesses. According to a report by Herrington *et al*. (2009) start-up businesses can be differentiated by their growth potential and sources of financial support. The majority of small businesses can be seen as *'lifestyle businesses'* as less than 10% of small businesses are *'entrepreneurial businesses'* (Herrington, *et al*., 2009, p. 123).

The dynamic differences between large and small businesses, management teams and entrepreneurs, and the different internal and external determinants and growth challenges all have a severe influence on the strategy and growth models (Davidsson, et al., 2010). The essence of the literature review on start-up businesses' strategy and growth models is to develop an understanding of the different entrepreneurial approaches and types that exist. It should also include the dynamics of existing strategy and growth models for entrepreneurs and start-up businesses in order to identify best practice in the literature.

1.2.5. COOPERATIVES MODELS

In general, cooperatives are legal entities based on set values and principles of collaboration (ICA, 2012). They are estimated to account for more than 1 billion members and more than 100 million employment opportunities (DSPD, 2013). According to the United Nations (1995)[1], cooperatives contribute to the economy, if fully developed, by reducing poverty, generating employment, integrating society and having a global impact.

Traditionally cooperatives are highly active in the agricultural sector, which was due to the role and control of government (Wanyama, et al., 2009), but in recent years cooperatives have become more hybrid and new generation cooperatives enable more versatile financing and control structures (Chaddad & Cook, 2004). According to Berube *et al*. (2012), cooperatives in comparison to listed public companies are globally competitive, while also having increased in the number of industry sectors.

However, challenges with cooperatives remain in agility in decision-making, pursuing new opportunity and financing, developing and sourcing talent, and managing the complexity with scaling (Berube *et al*., 2012; and Nixon, 2012). The essence of the literature review on cooperatives is to develop an understanding of the different cooperative structures and models while finding solutions to overcome challenges and determinants. The aim of the literature review on cooperative models will be to identify best practice approaches, types and models in order to develop appropriate alternative solutions.

1.2.6. KNOWLEDGE MANAGEMENT MODELS

The definition of knowledge is a continuously debated topic among philosophers in the field of epistemology (Schutte, 2010) with several definitions, types and theories attempting to explain its existence. The role of knowledge is that it forms the basis for developing innovation and a competitive advantage (Bornemann *et al.,* 2003; Hayes, 2010; Schutte, 2010).

Eisenmann *et al.* (2011) and Ries (2010) argue the process of validated learning while entrepreneurship further emphasises the leveraging of knowledge to develop business growth. The essence of knowledge management and networks that support entrepreneurship and innovation will help develop alternative solutions. Therefore, the aim of this literature review on knowledge management and networks will be to identify best practice approaches, types, challenges and models that support innovation.

1.2.7. SUMMARY

The preliminary literature review has identified multiple domains with the underlining focus on entrepreneurship and innovation while each domain is providing certain benefits and drawbacks in supporting the entrepreneurial and innovation process. Notably, the domains of innovation ecosystems, venture capital

[1] More information on United Nations, 2014. *Cooperatives*. [Online] Available at http://undesadspd.org/Cooperatives.aspx [Accessed 30 October 2014].

models, start-up businesses and cooperative models all provide socio-economic development through employment generation, poverty alleviation and economic benefits locally, nationally and internationally.

The challenges created by the external environment and the alignment required by the internal capacity of the entrepreneurial start-up businesses inhibits their growth potential which is necessary for socio-economic impact. Each of these domains provides a solution to the complex problem of successful commercialisation of intellectual property and technology.

However, none of the domains solely provides a whole solution which seems to require a more integrated solution of multiple domains. The ecosystems that have been more successful in establishing and fostering entrepreneurship and innovation (e.g. Silicon Valley, Switzerland, Tel Aviv), primarily developed a pipeline of entrepreneurial start-up businesses that are supported throughout the innovation value chain.

1.3. RESEARCH PURPOSE AND SCOPE

The purpose of this research study is to develop an alternative solution to fostering and supporting entrepreneurship and innovation throughout the innovation value chain by establishing a pipeline of entrepreneurial start-up businesses. The purpose of the pipeline is specifically to support entrepreneurs in the commercialisation process of intellectual property and technology with the goal of creating a sustainable and lasting socio-economic impact.

In developing this pipeline, literature suggests a conceptual framework as an appropriate representation technique to illustrate the pipeline (Mouton, 2001), while a systems engineering and enterprise engineering approach is decided on to develop the conceptual framework. In an innovation ecosystem there are numerous stakeholders between public, private and social sectors that play a vital role in entrepreneurship and innovation. Therefore, the pipeline is not limited to any particular organisation, and neither is the commercialisation process which complicates the development and application of the conceptual framework.

In order to restrict the complexity of an extensive research scope, the application of the conceptual framework will specifically focus on intellectual property and technology of public-funded universities in South Africa. This particular scope was decided on for the important role universities play in the innovation ecosystem. They receive extensive support from the public and private sector, while technology transfer offices provide diffusion of intellectual property and technology to the private sector. The pipeline will support the commercialisation process and the movement towards traditional universities becoming entrepreneurial universities.

1.4. RESEARCH METHODOLOGY

This research study is predominantly qualitative based, and it is decided on to use the constructivism theory as the underlining argument for this research inquiry and for developing a conceptual framework. In order to address the complexity of the research problem, a systems engineering approach is chosen to guide the research process in conjunction with the constructivism theory. The aim of this research inquiry is to develop understanding of knowledge accumulation, and the nature of knowledge reconstruction provides coalescing around knowledge consensus (Guba & Lincoln, 1994, p. 112). The creation of new knowledge will be argued to provide more informed and sophisticated understanding of the knowledge reconstruction.

1.4.1. RESEARCH METHOD AND DESIGN

The constructivism theory is the root of the research methodology whereby the extensive literature uses deductive reasoning that is followed by inductive reasoning in developing the conception framework. Due to the nature of complexity of this research inquiry and particular problem, a systems engineering approach is chosen to support and guide the research process by achieving the research objectives through solving the identified research questions.

The systems engineering process and approach is described in more detail below, and it is based on research methodology by Kennon (2010). It is also formulated based on the research design map and document outline consisting of the following nine sections (Mouton, 2008; Kennon, 2010):

- **(1)** Introduction to the purpose of the research journey and research methodology.
- **(2)** Problem definition to define the research opportunities and gap in the innovation ecosystem and higher education institutions with a particular focus on South Africa's innovation ecosystem.
- **(3)** Literature review on the following:
  - **(a)** Innovation and venture capital models,
  - **(b)** Start-up business growth models and strategies, and
  - **(c)** Knowledge management and cooperative models.
- **(4)** Synthesis of literature review and formulation of best practices.
- **(5)** Developing a conceptual framework based on the best practices from the literature review.
- **(6)** Explaining the conceptual framework and apply the framework to a case study as an application example.
- **(7)** Validating the conceptual framework through interviews with industry experts.
- **(8)** Adjusting the conceptual framework with recommendations from validation interviews.
- **(9)** Research conclusions and recommendations.

In summary, the research method designed specifically for this research inquiry consists of a systems engineering approach to support the constructivism theory's reasoning and developing of the conceptual framework. The complexity and nature of the problem is not only aligned with the nature of systems engineering, but the sub-discipline of enterprise engineering is a suitable domain to verify the conceptual framework developed in its principles and practical approach (Dietz, 2006; Dietz *et al.*, 2013). These particular aspects of this research methodology will be discussed in more detail below.

1.4.1.1. SYSTEMS ENGINEERING APPROACH

The discipline of systems engineering specifically addresses complex problems in systems and industry by finding dynamic and systematic solutions (INCOSE, 2006). Systems engineering approaches can generally be categorised into six categories, namely, linear systems (e.g. black box), dynamic systems, discrete event systems, agent-based systems, system dynamics, and hybrid systems. The most suitable systems engineering approach for this research methodology is a basic linear systems engineering approach.

This system engineering approach is illustrated in Figure 1.1 below and consists of four phases. The first (I) phase explains the complex problem as a whole that the research study is addressing. The second (II) phase is the process of deconstructing the complex problem into functional units or sub-problems. The third (III) phase develops by an improved understanding of the various sub-problems and subsequently provides solutions to the sub-problems by forming the functional unit solutions or sub-solutions. The fourth (IV) phase integrates the various sub-solutions to provide a potential solution for the whole system.

Essential to this problem-solving approach is that the desired sub-problems are solved by the sub-solutions in order to ensure that the desired objective of the system is achieved. In other words, the solution for the whole system will be represented by the conceptual framework and will be verified by a feedback system comprised out of enterprise engineering structural components that need to be satisfied by the conceptual framework.

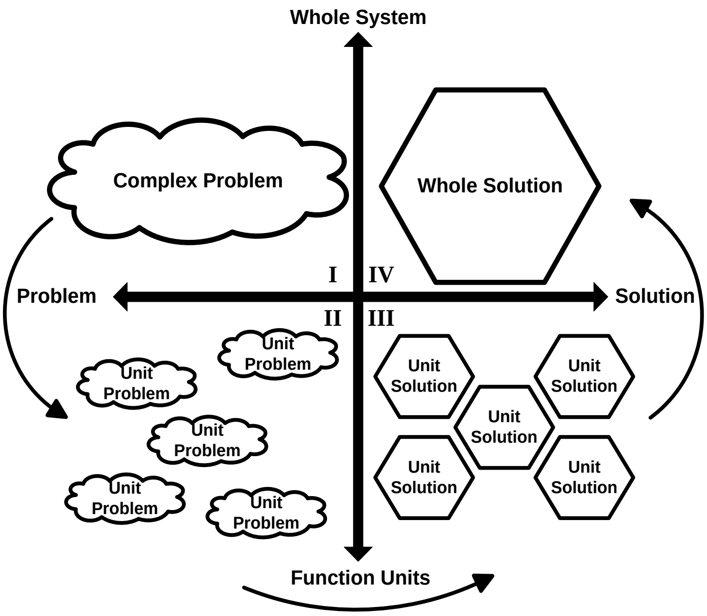

Figure 1.1: Flow of Real World Problem-Solving adapted from Kennon (2010)

1.4.1.2. CONCEPTUAL FRAMEWORK

The Compact Oxford Dictionary[2] defines a framework as "*a supporting or underlying structure or a set of assumptions, concepts, values and practices that constitutes a way of viewing reality*". According to Kappel (2001), Kostoff and Schaller (2001), and Phaal, Farrukh and Probert (2004), frameworks have developed into accepted structure to represent and illustrate processes, procedures and life-cycles.

The purpose of developing a conceptual framework is to illustrate the whole solution of the fourth phase in the systems engineering approach. The literature consensus deems conceptual frameworks as an acceptable representation tool, while McMahon (1998) argues that the framework could necessarily aid in establishing a long-term vision and strategic intent for the small businesses to grow.

However, the development of the conceptual framework requires a particular framework development methodology that details the design and the construction process of the conceptual framework. This framework development methodology is described in detail in Chapter 6, while the conceptual framework is illustrated in Chapter 7.

Notably, the framework development methodology is critical as it is aligned to form part of the research methodology in representing the whole solution. The literature review is then crucial in formulating the design criteria which are the unit solutions of the whole solution.

1.4.1.3. ENTERPRISE ENGINEERING

Enterprise engineering is a sub-discipline of systems engineering and specifically relates to engineering principles and components relating to the development of an enterprise. A formal definition of enterprise engineering was defined by the Society for Enterprise Engineering as "*the body of knowledge, principles and practices applicable in the analysis, design, implementation and operation of an enterprise*" (Liles, et al., 1995). The core aspects of enterprise engineering include the combination of business processes, information flows and organisation structure (Dietz, 2006).

The role of enterprise engineering in this research methodology is to verify the conceptual framework that is developed for specific structural components. The enterprise engineering methodology forms part of the framework development methodology and will be developed based on the Dietz, Hoogervorst, *et al*. (2013) classification scheme for enterprise engineering. The enterprise engineering methodology will act as a high-level structural components checklist for the developed conceptual framework to verify the quality of the framework developed. This is described in more detail in Chapter 6 and applied to the conceptual framework in Chapter 8.

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[2] Also referenced by *Farlex: Free Dictionary*. [Online] Available at http://www.thefreedictionary.com/framework [Accessed on 20 October 2014].

1.4.2. RESEARCH PROBLEM DEFINITION

This research study addresses the need for regions and countries in supporting open market economies to develop a healthy private sector in order to gain the benefits of socio-economic development. This is because regions and countries need to thrive on entrepreneurship and innovation in order to remain globally competitive through establishing an innovation ecosystem.

The role of regions and countries in developing a legal platform that provides an environment conducive to doing business and that enables businesses to overcome these challenges becomes crucial in order to gain the benefits from socio-economic development. However, the intrinsic balance between implementing legislation and creating a business environment is far more complex. Aspects such as social culture, political culture and foreign direct investment all play a role. One approach is to focus on the need to develop a healthy private sector through creating an innovation pipeline of businesses to compete on an international basis.

Alternative solutions are required in order to develop a healthy private sector that will support the process of taking intellectual property and technology to market that will promote entrepreneurship and innovation. This need for entrepreneurship and innovation is essential for businesses to develop and sustain a competitive advantage which becomes a necessity of survival. The need is crucial for both large and start-up businesses, as research and development (R&D) plays a vital role in generating intellectual property and technology, but R&D without commercialisation thereof prohibits successful innovation. Therefore, the essence of the innovation process lies in taking technology to market and driving the commercialisation process.

This commercialisation process is generally different in large and small businesses as large businesses have already established a market position and obtained resources (including financing), while start-up businesses are limited in resources and market position and are required to still develop a business and the technology. It can further be broken down into supporting the early stages of the commercialisation process whereby the challenges known as the '*valleys of death*' need to be overcome. The role of the innovation pipeline is specifically aimed at supporting start-up businesses in overcoming the '*valleys of death*' which indirectly supports the larger businesses and ultimately supports the development of the innovation ecosystem.

The problem defined in this research study can be summarised as the necessity for an innovation pipeline that supports and promotes entrepreneurship and innovation in a region or country that will enable the positive impact of socio-economic development.

1.4.3. RESEARCH QUESTIONS

The designed research methodology of this research study requires that the complex problem is formulated into a main research question [MRQ] and then broken up into unit problems which will be represented by sub-research questions [SRQs]. The unit problems are then synthesised into corresponding unit solutions which in combination aim to support the framework development methodology which is aligned with the whole solution.

In the preliminary literature review, the complex problem was identified and formulated with the underlining concepts relating to entrepreneurship and innovation. The preliminary literature review also gave the initial basis for generic SRQs to be formulated with respect to developing a better understanding of the complex problem which will be investigated more extensively in the literature review.

1.4.3.1. MAIN RESEARCH QUESTION

The complex problem of this research study is formulated into the following MRQ:

[MRQ]: ***What alternative solution can be developed that will support and promote an entrepreneurial and innovation pipeline that specifically focuses on the value chain of commercialisation?***

1.4.3.2. SUB-RESEARCH QUESTIONS

The MRQ forms the basis together with the preliminary literature review to develop generic SRQs, but additional SRQs will be added specifically to narrow down the research scope, as well as other emerging questions that result from the extensive literature review. The generic RSQs are questions that are formulated specifically to identify best practice models from the literature.

The SRQs are synthesised in Table 1.1 below and are continuously updated as the literature review continues. These SRQs are related to the specific sub-research objectives (SROs) which formulate the unit solution. It is worth noting that the numbering of each SRQ and SRO is aligned to their respective chapter. The role of the SRQs and SROs is to support the framework development methodology to formulate design criteria for the development of the framework.

Table 1.1: The Sub-research Questions related to each respective chapter

Ref. Code	Sub-Research Questions	Source	Related Objective	Related Chapter
RSQ:2.1	*What is an innovation ecosystem?*	*Preliminary literature review: Innovation Ecosystem*	***RSO:2.1***	***Chapter 2***
RSQ:2.2	*What is the function and role of the innovation ecosystem?*			
RSQ:2.3	*What is the value chain in the innovation ecosystem?*			
RSQ:2.4	*What is the role of entrepreneurial start-ups in the innovation ecosystem?*			
RSQ:2.5	*What is the life cycle of innovation as defined by the innovation ecosystem?*			
RSQ:2.6	*What is the valley of death?*			
RSQ:2.7	*What is the general commercialising challenge in an innovation ecosystem?*			
RSQ:2.8	*What is the role and functions of universities in the innovation ecosystem?*	*Research scope: South African Universities*		
RSQ:2.9	*What is the role of universities in commercialising intellectual property?*			
RSQ:2.10	*What is the role and function of Technology Transfer offices?*	*Emerging concept from the literature: TTO Models*	***RSO:2.2***	
RSQ:2.11	*What are the different Technology Transfer office structures?*			
RSQ:2.12	*What are the performance measurements and requirements of Universities and Technology Transfer Offices commercialising intellectual property?*			
RSQ:2.13	*What are the challenges and detriments for Technology Transfer offices commercialising intellectual property?*			
RSQ:2.14	*What is the dynamics of South African innovation ecosystem?*	*Research scope: South Africa Universities*	***RSO:2.3***	
RSQ:2.15	*What are the public funded universities producing innovation output in South Africa?*			
RSQ:2.16	*What are the various role players in commercialising intellectual property in South Africa?*			
RSQ:2.17	*What is the funding support for start-up businesses in South Africa?*			
RSQ:2.18	*What is the development support for start-up businesses in South Africa?*			
RSQ:2.19	*What are the challenges and detriments for start-up businesses (entrepreneurial) in South Africa's ecosystem?*			
RSQ:2.20	*What is the valley of death in South Africa?*			
RSQ:3.1	*What is the definition of innovation and innovative approaches?*	*Preliminary literature review: Innovation Models*	***RSO:3.0***	***Chapter 3***
RSQ:3.2	*Why is innovation important?*			
RSQ:3.3	*What is innovation management?*			
RSQ:3.4	*What is the role of innovation models?*			
RSQ:3.5	*What are the different types of innovation process models?*			
RSQ:3.6	*What are the advantages and disadvantages of innovation models?*			
RSQ:3.7	*What are the best practices of innovation models?*			

Ref. Code	Sub-Research Questions	Source	Related Objective	Related Chapter
RSQ:3.8	*What is venture capital?*	*Preliminary literature review: Venture Capital Model*		
RSQ:3.9	*Why is venture capital important?*			
RSQ:3.10	*What is the typical venture capital model?*			
RSQ:3.11	*What type of venture capital models are there?*			
RSQ:3.12	*What is the venture capital process?*			
RSQ:3.13	*What are the advantages and disadvantages of venture capital model?*			
RSQ:3.14	*What is essential for a venture capitalist to invest in an entrepreneurial start-up business?*	*Emerging concept: VC Principles, Traction & Exit Strategies*		
RSQ:3.15	*What are the principles and best practice of venture capitals?*			
RSQ:3.16	*What are exit strategies and why is it important to venture capitalists?*			
RSQ:4.1	*What is the role of the entrepreneur in a start-up business?*	*Preliminary literature review: Entrepreneurship, Start-ups Businesses, Strategy & Growth Models*	***RSO:4.0***	***Chapter 4***
RSQ:4.2	*What are the different entrepreneurial approaches?*			
RSQ:4.3	*What are the difference between management and entrepreneurs?*			
RSQ:4.4	*What are the barriers and inhibitors of start-up business developing?*			
RSQ:4.5	*What are the components of business growth?*			
RSQ:4.6	*What is the definition of strategic management for start-up businesses?*			
RSQ:4.7	*What is the role of strategy?*			
RSQ:4.8	*What are the different strategic management models for start-up businesses?*			
RSQ:4.9	*What is the definition of growth for start-up businesses?*			
RSQ:4.10	*What are the different growth models and theories for start-up businesses?*			
RSQ:4.11	*What is the lean start-up methodology?*	*Emerging concept: Lean*		
RSQ:4.12	*What is the growth states models for start-up business?*			
RSQ:4.13	*What is the lean growth methodology for start-up businesses?*			
RSQ:5.1	*What is the definition and role of knowledge management?*	*Preliminary literature review: Knowledge Management*	***RSO:5.1***	***Chapter 5***
RSQ:5.2	*What is the implications and considerations of using knowledge management?*			
RSQ:5.3	*What are the different knowledge management models and frameworks?*			
RSQ:5.4	*What is the best practice of knowledge management?*			
RSQ:5.5	*What is the relationship between innovation and knowledge?*			
RSQ:5.6	*What is the definition of knowledge and intellectual capital?*	*Emerging concept: Intellectual Capital*		
RSQ:5.7	*What are the types of knowledge and intellectual capital?*			
RSQ:5.8	*What is the definition, role and purpose of integrated knowledge networks?*	*Emerging concept: Knowledge Networks*		
RSQ:5.9	*What are the different types of knowledge networks?*			
RSQ:5.10	*What is the best practice of integrated knowledge networks?*			
RSQ:5.11	*How does integrated knowledge network improve the structural performance of an organisation?*			

Ref. Code	Sub-Research Questions	Source	Related Objective	Related Chapter
RSQ:5.12	*What is the definition, role and purpose of a cooperative?*	*Preliminary literature review: Cooperatives*	***RSO:5.2***	
RSQ:5.13	*What are the different types and models of cooperatives?*			
RSQ:5.14	*What are the advantages and disadvantages of cooperative models?*			
RSQ:5.15	*What are the growth challenges of cooperatives?*			
RSQ:5.16	*What is the best practice of cooperatives?*			
RSQ:5.17	*What is the relation between cooperatives and entrepreneurship?*			
RSQ:5.18	*What is the global competitiveness of cooperatives?*	*Emerging concept: Knowledge Networks*		
RSQ:5.19	*Can a cooperative model be used as a venture capital model?*			
RSQ:5.20	*What is cooperatives state of cooperatives in Africa and South Africa?*	*Research scope: South Africa*	***RSO:5.3***	
RSQ:5.21	*What is the legislation of cooperatives in South Africa and other considerations?*			

1.4.4. RESEARCH OBJECTIVES

The research methodology includes the formulation of unit solutions that is achieved in part by the formulation of SROs, but also by the formulation of design criteria for the development of the conceptual framework. The SROs are also aligned with the overall objective aimed to be achieved in each chapter while the MRO is aligned with the complex problem and the MRQ. The MRO can also be seen as an overall objective that is aimed to be achieved by the whole solution.

1.4.4.1. SUB-RESEARCH OBJECTIVES

The SROs are formulated based on the SRQs and synthesis in Table 1.2 below. Each SRO is synthesised with its related solution method and related chapter wherein the unit solution is achieved, as well as a general objective for the additional chapters.

Table 1.2: The Sub-research Objectives related to each chapter

Ref. Code	Sub-research Objective	Solution Method	Reference Chapter
SRO:2.1	*Develop an understanding of the dynamics of the innovation ecosystem.*	Literature Review	***Chapter 2:*** Innovation Ecosystems & South Africa
SRO:2.2	*Determine the best practice and role of technology transfer models.*		
SRO:2.3	*Develop an understanding of the dynamics of South Africa's innovation ecosystem.*		
SRO:3.0	*Determine the best practices between innovation and venture capital models.*	Literature Review	***Chapter 3***: Innovation & Venture Capital Models
SRO:4.0	*Develop an understanding of the dynamics revolving entrepreneurial start-up businesses in terms of challenges, strategy and growth models.*	Literature Review	***Chapter 4:*** Start-up Businesses Growth Models & Strategy
SRO:5.1	*Determine the best practices of knowledge management and networks models.*	Literature Review	***Chapter 5:*** Integrated Knowledge Networks & Cooperative Models
SRO:5.2	*Determine the best practices of cooperative models.*		
SRO:5.3	*Develop an understanding of the dynamics of cooperatives in South Africa.*		
SRO:6.0	*Develop the guidelines, process and design criteria of the conceptual framework using a black box systems engineering approach.*	Black Box Systems Engineering	***Chapter 6:*** Developing a Conceptual Framework
SRO:7.0	*Develop the cooperative venture capital framework using formulated enterprise engineering structural components and design criteria, as well as illustrate the framework in a case study of Stellenbosch University ecosystem.*	Enterprise Engineering & Design Criteria	***Chapter 7:*** A Cooperative Venture Capital Framework
SRO:8.0	*Develop a validation strategy through using interview industry experts as validation and enterprise engineering components verification of the developed framework.*	Industry Expert Interviews	***Chapter 8:*** Framework Verification & Validation Strategy

Ref. Code	Sub-research Objective	Solution Method	Reference Chapter
SRO:9.0	*Adjust the framework based on the feedback received from the interviews with industry experts.*	Feedback from Interviews	***Chapter 9:*** Feedback and Framework Adjustments
SRO:10.0	*Confirm the alignment between the research methodology and the concluding findings, as well as provide the necessary significance and recommendations for future research.*	Alignment & Findings	***Chapter 10:*** Research Conclusion and Recommendations

1.4.4.2. MAIN RESEARCH OBJECTIVE

The main research objective [MRO] is aligned with the MRQ, SRQs and MROs, and formulated as follows:

[MRO]: ***Develop an alternative solution that will support and promote an entrepreneurship and innovation pipeline that will specifically focus on the value stream of commercialisation.***

1.4.5. RESEARCH METHODOLOGY SYNTHESIS

The research methodology of this research study is listed in a stepwise process in section 1.4.1 and is combined with the systems engineering approach (refer to Figure 1.1 above) to illustrate the practical application of the research methodology. This is illustrated in Figure 1.2 below, and the numbered steps are synced with the stepwise process which is conceptually embedded in relation to the systems engineering approach.

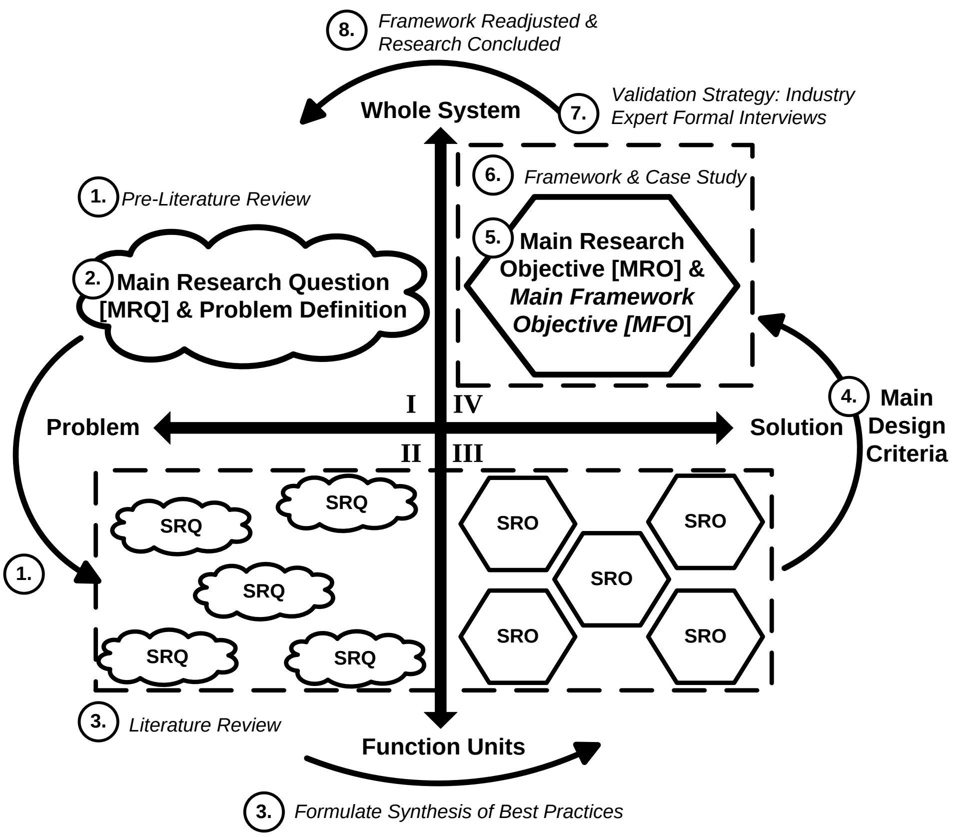

Figure 1.2: Research Methodology Synthesis

1.5. OVERVIEW OF THE VERIFICATION AND VALIDATION STRATEGY

This research study is qualitative based and uses internal verification and external validation techniques to validate the research. The main techniques used are namely: **(1) literature review**, **(2)** framework **structural requirements**, **(3)** a **case study** to evaluate and verify the research produced, and **(4) structured and semi-structured interviews** with industry experts. The first three techniques form part of the internal verification of the research, while the fourth technique will seek external validation apart from this research study. The different techniques play different roles in the verification and validation strategy which is described in more detail in Chapter 8 and how they fit together in the research methodology (refer to Figure 3 above).

The **literature review (1)** will provide already validated research, primarily formulating the foundation for the development of the framework. It has three components to it, namely, the **(a)** preliminary literature review and problem definition, the **(b)** ecosystem gap analysis literature review, and the **(c)** best practices literature review. They are described as follows:

- **(a)** The preliminary literature review governs the initial problem definition found in the literature and formed the basis from which the research proposal in Chapter 1.
- **(b)** The ecosystem gap analysis literature review in Chapter 2 is the analysis of the defined problem and research scope as well as forming the input components of the framework.
- **(c)** In Chapters 3 to 5, a literature review of the best practices is discussed and analysed for the purpose of developing design criteria for the framework.

The framework **structural requirements (2)** are compiled from a literature review on the specific structural requirements and enterprise engineering principles the framework needs to fulfil in order to comply with the set scope of this framework. This is discussed in detail in Chapter 6 as part of the framework development methodology. It verifies the compliance of the framework to enterprise engineering components and subsequently an appropriate research study in the field of engineering management.

A **case study (3)** method is used as a practical application example of the framework whereby the framework will be applied to the University of Stellenbosch ecosystem. The output produced from the framework will create a specific cooperative venture capital model for the Stellenbosch University ecosystem. The purpose of this case study is to evaluate and validate the research output produced which serves as the whole solution in the research methodology (refer to Figure 2 above). The design of the case study is as follows (Leedy & Ormrod, 2013):

- **(a)** Defining the purpose of the case study by understanding the organisation in depth.
- **(b)** Defining the focus of the case study on a particular organisation.
- **(c)** Method of collecting data through interviews and appropriate written documents.
- **(d)** Method for data analysis by synthesis of the data into an overall portrait of the case.

Then lastly, **structured and semi-structured interviews (4)** with pre-identified industry experts are used to provide guidance between industry knowledge and theoretical knowledge. The purpose is to validate the different components of the framework and the application of the case study. The structured interviews with industry experts will aim to validate specific components of the framework and case study, while the semi-structured interviews aim to validate the framework, but also to identify recommendations. Through using a standard set of structured and semi-structured questions combined with individually tailored questions for the key intellectuals, they can provide reasons and clarification for their recommendations (Leedy & Ormrod, 2013).

It is important to note that this section gives an overview of the validation strategy of the research methodology implemented in this research study and only briefly touches on the validation of the framework. The framework and its case study's verification and validation strategy are discussed in detail in Chapter 8.

1.6. DELIMITATIONS AND LIMITATIONS

The scope of this research study is defined by the delimitations and limitations which create the boundary area for the application of this research. In Chapter 7, more information is given on specific details pertaining to the application of the conceptual framework. However, an overview of the boundary area for this research study will be discussed below.

1.6.1.1. DELIMITATIONS

An overview of this research study's delimitations includes the following aspects:

- The research methodology provides a systems engineering approach to commercialisation;
- The framework development methodology provides the development of an enterprise engineering structural components checklist;
- The conceptual framework specifically focuses on supporting and promoting entrepreneurship and innovation;
- The conceptual framework provides an alternative solution to driving the commercialisation process;
- The conceptual framework and case study will be validated through interviewing industry experts.

1.6.1.2. LIMITATIONS

An overview of this research study's limitations includes the following aspects:

- This research study is a qualitative based study as the formulation of a framework is a conceptual idea, and is not validated by empirical data;
- The developed framework will not be focusing on all types of intellectual property and will only focus on intellectual property and technology that can be taken to market;
- In this research study, it is not possible to produce a practical application of the framework and it remains a conceptual framework.

1.7. PRELIMINARY EXPECTED RESULTS AND RESEARCH NOVELTY

The expected result from this research study is to develop a conceptual framework that supports and promotes entrepreneurship and innovation. This conceptual framework will provide a unique, alternative solution in establishing an innovation pipeline for socio-economic development. The other unique contribution is the creation of research methodology and framework development methodology providing a systematic approach to driving the commercialisation process. The specific focus on commercialising intellectual property of South African universities is also another unique contribution expected to support the movement towards entrepreneurial universities.

1.8. DOCUMENT OUTLINE

The document structure uses a colour reference approach throughout the research study whereby each chapter is assigned a colour and is briefly described in the document outline below:

1 **The Research Journey**

This is the start of the research journey. It includes a preliminary literature review defining the research purpose and scope. This was used to formulate the research methodology that includes the research problem; research questions and objectives; the research delimitation and limitation; and lastly it describes the document outline.

2 **Innovation Ecosystems and South Africa**

This is the start of the literature review. It includes a review of innovation ecosystems and best practice models. A specific focus on technology transfer and university commercialisation models are also reviewed, while it concludes with an overview of South Africa's innovation ecosystem.

3 **Innovation and Venture Capital Models**

This literature review focuses on innovation and venture capital models. It includes an overview of the dynamics of innovation models and processes, as well as the dynamics of venture capital and their respective models. The review evaluates the best practice models and defines the tools and concepts required for the framework.

4 **Start-up Business Strategy and Growth Models**

This literature review focuses on entrepreneurs and start-up business. It includes an overview of the dynamics of start-up businesses and the respective strategies and growth models. The review evaluates the strategic growth models and defines best practice as tools and concepts required within the framework.

5 **Knowledge Management and Cooperative Models**

This literature review focuses on knowledge management and cooperatives. It includes an overview of the dynamics of integrated knowledge networks and models as well as the dynamics of cooperatives and their respective models. The review evaluated the best practice models and defines the tools and concepts required for the framework.

6 **Developing a Conceptual Framework**

This chapter defines how the conceptual framework is developed. A specific framework development methodology is created consisting of design criteria from the literature review and an enterprise eningeering structural component checklist.

7 **A Cooperative Venture Capital Framework**

This chapter discusses all the components of the conceptual framework acoording to the design criteria of the framework development methodology. The framework is also applied in the case study of the University of Stellenbosch ecosystem.

8 **Framework Verification and Validation Strategy**

This chapter is where the research is verified and validated according to the research methodology. It includes the framework and case study being verified by the enterprise engineering structural components checklist and validated by interviews with industry experts.

9 **Framework Feedback and Adjustments**

This chapter uses the feedback received from the validation strategy to adjust the framework. It includes the recommendations from industry experts on the developed framework and adjusts it accordingly to incorporate their recommendations.

10 **Research Conclusion and Recommendations**

This chapter provides the final outcomes, conclusions and recommendations found in the process of this research methodology. It also provides the significance and future research opportunities of this research study.

2 Innovation Ecosystems and South Africa

This is the start of the literature review. It includes a review of innovation ecosystems and best practice models. A specific focus on technology transfer and university commercialisation models are also reviewed, while it concludes with an overview of South Africa's innovation ecosystem.

2.1. INTRODUCTION

In today's era of globalisation, the ownership of the economy can be divided among the following stakeholders; the public or state sector, the private sector or privately run businesses and the social or voluntary sector. These stakeholders play a vital role in developing the economy with access to open markets. This is where an ***innovation ecosystem*** ultimately becomes important and is subsequently comprised out of two distinct economies; the knowledge economy and the commercial economy at different levels as in the triple helix model illustrated below (refer to Figure 2.1).

The dynamics of surrounding innovation ecosystems forms the core of this literature review, in order to develop a better understanding of the best practices involved in innovation. The sub-research questions (SRQs) defined for this chapter are listed in Table 1.1 and include SRQ:2.1-2.20. The objectives of this chapter are listed as three distinct objectives and include the following (refer to Table 1.2):

[SRO:2.1] ***Develop an understanding of the dynamics of the innovation ecosystem.***

[SRO:2.2] ***Determine the best practice and role of technology transfer models.***

[SRO:2.3] ***Develop an understanding of the dynamics of South Africa's innovation ecosystem.***

The three distinct objectives relate to developing a deeper understanding on innovation ecosystems and technology transfer models, while also specifically focusing the research scope on South Africa's innovation ecosystem. The specific research scope is defined in order to outline boundaries of the problem statement with regards to the relevant stakeholders involved in the commercialisation process. Therefore, an adequate gap analysis can be conducted on South Africa's innovation ecosystem.

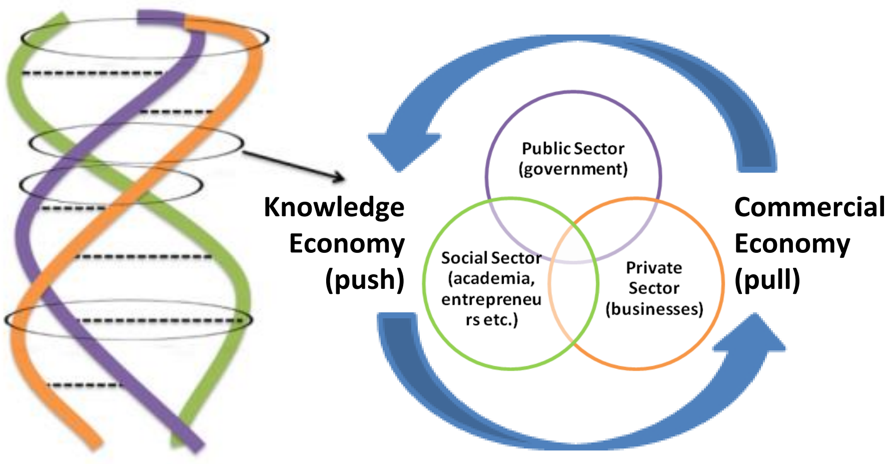

Figure 2.1: The Ownership Stakeholders of the Economies at Play Forming a Triple-Helix Model adapted from Etzkowitz & Leydesdorff (2000), Jackson (2011) and Visser (2011)

2.2. INNOVATION ECOSYSTEM

2.2.1. DEFINING AN INNOVATION ECOSYSTEM

The definition of the term *'innovation ecosystem'* seems to have no general consensus by academics for the exact definition. Some academics argue that the term '*innovation ecosystem*' is a synonym for 'innovation system'. Other academics separate the terms, labelling the *"innovation ecosystem"* as the ecological environment of innovation (Ayrikyan & Zaman, 2012) and *'innovation system'* as the planned process of innovation in a given environment (OECD, 1997).

The key aspects to understanding form part of new and evolving concepts regarding economic development. This dates back to 1841 with *George F. List* coining the term *"national system"* for Germany to catch up economically with Britain. In 1950 *Eric Dahmén* introduced the term *'development blocks'* which was inspired by the work of *Joseph A. Schumpeter* for the economic development and industrial transformation of Sweden. In the late 1980s *Christopher Freeman* and *Bengt A. Lundvall* developed the concept of *"national system of innovation"*; *Michael Porter's* "*The Competitive Advantage of Nations*" publication in 1990 introduced the concept of *"clusters";* and eventually in 2010 Stanford University in partnership with China, Finland and Japan initiated a *global innovation ecosystems network*.

In a study by Jackson (2011), she attempted to define what an innovation ecosystem is by comparing it with a biological ecosystem. She defined that the innovation ecosystem is in contrast to the biological system, a model of the economy with the purpose of enabling innovation and technology development. She further stated that the innovation ecosystem embraces two economies, the commercial economy (pull) driven by open markets and the knowledge economy (push) driven by research and development. These two economies work in equilibrium with one another and importantly, the knowledge economy's available resources are in the cycle related to the commercial economy's resources as illustrated in Figure 2.2 below.

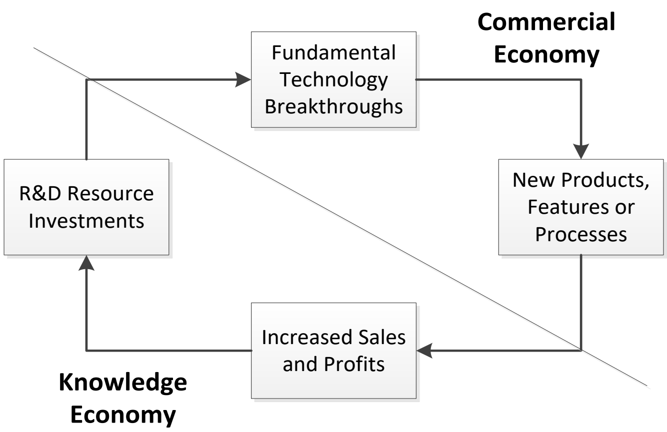

Figure 2.2: Equilibrium Cycle between the Knowledge Economy and Commercial Economy of a Thriving Innovation Ecosystem (Jackson, 2011)

Similar to Jackson's proposed innovation ecosystem model is a study by Wang (2009). Wang's theoretical model is illustrated in Figure 2.3 below and defines the *"complex innovation ecosystem as networks of innovations and communities of people and organizations interact to produce and use the innovations".* The model defines a main innovation producing community ("A") governed by a supply and demand ecosystem between producers and users of innovation. Therefore, the main community ("A") subsequently enables the other sub-innovation communities ("B" and "C") to be formed and benefit from the existing main community.

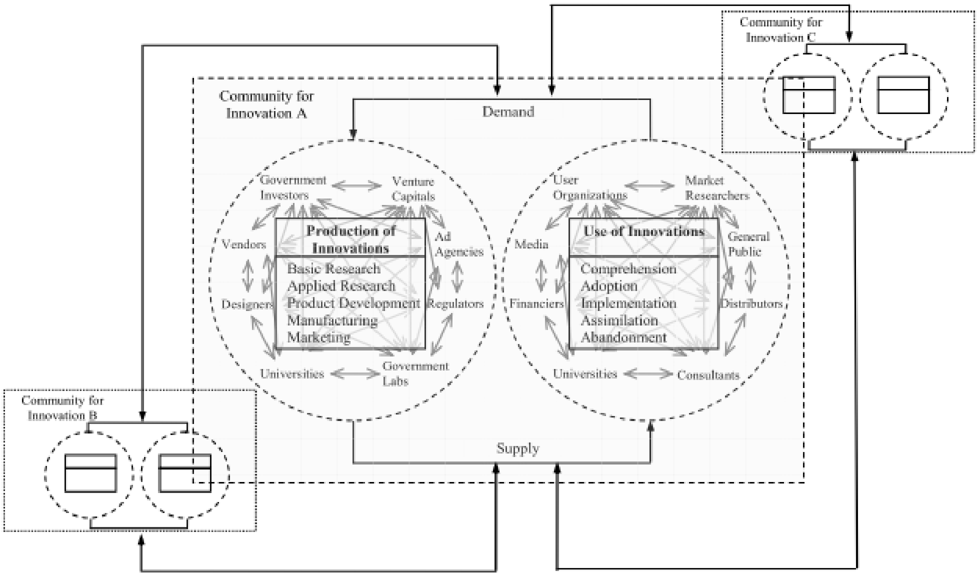

Figure 2.3: The Innovation Ecosystem Model Governed by Supply and Demand as well as the Associated Subcommunities for Innovation Surrounding the Main Innovation Producing Community (Wang, 2009)

In more recent developments, the World Intellectual Property Organisation (WIPO) is developing a *'Danube Innovation Partnership'* initiative aimed at developing an innovation ecosystem between countries of the Danube region. They define an innovation ecosystem as a "*framework of interconnected and interdependent public and private structural elements (policies, organizations, funds and people) and relationships"* (WIPO, 2013). In Figure 2.4 below, the various components of the innovation ecosystem are defined which support the commercialisation process of innovation for economic development.

In addition to the definitions mentioned above, the Global Innovation Index *(GII)* (2013) report uses a tool measuring 84 metrics to gauge the **"innovation index"** per country. The Global Innovation Index (average) and Innovation Efficiency Ratio is the final function based on the two main subindexes, innovation input and innovation output as illustrated in Figure 2.5 on the next page. The key subindexes, innovation input is further subdivided into five pillars all relating to creation and enabling activities of intellectual property and technology for a national economy, while the innovation output only consists of two pillars all relating to the result of innovation output.

A serious critique of the GII (2013) innovation output is the lack of specific measurement with regards to impact of entrepreneurial start-up businesses. Even though indirectly, some of the entrepreneurial start-up businesses' activities are measured through indicators such as new business density, high-tech and medium-tech output, high-tech export, and communications, computer and information services export, it does not inclusively measure the impact that entrepreneurial start-up businesses have on the economy.

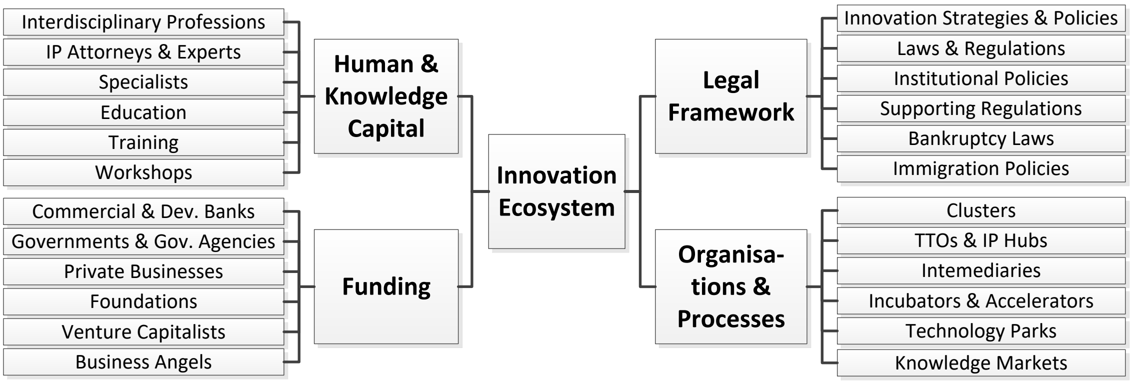

Figure 2.4: The Various Components of the Innovation Ecosystem (WIPO, 2013)

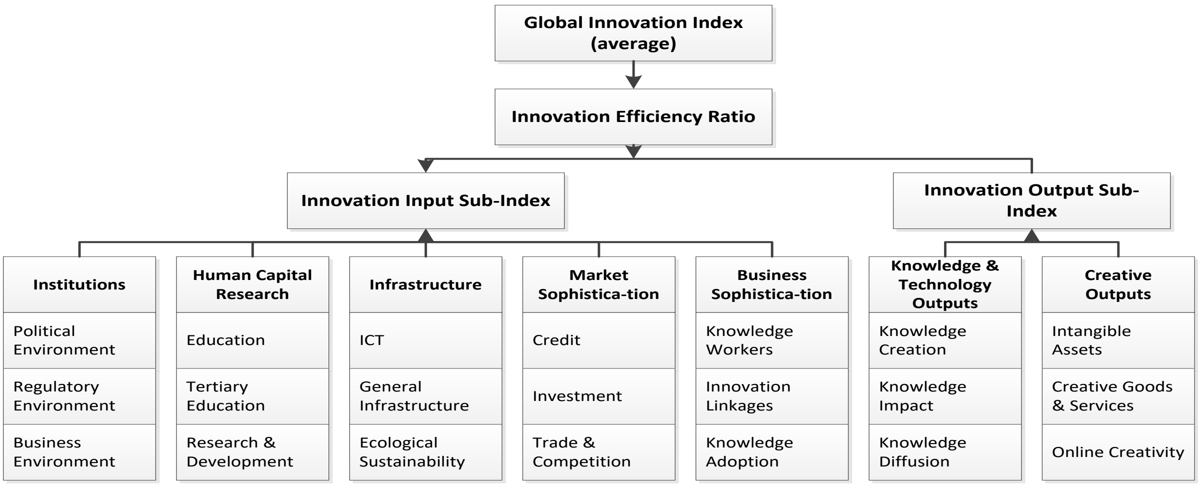

Figure 2.5: The Innovation Metric adopted Framework of the Global Innovation Index (2013)

Additionally, university technology transfer offices (TTOs) also produce spin-off companies from the innovation input and research produced. It is also important to note that private businesses in developed countries spend far more on research and development (R&D) than governments or public funded organisations (OECD, 2010;Booz & Company, 2013). The impact of 'start-up ecosystems' on innovation output can clearly be argued for and should be considered as a vital pillar of any innovation ecosystem.

In conclusion, an innovation ecosystem is strong correlated and forms a vital part of the start-up ecosystem. The innovation ecosystem plays a vital role for economic development by embracing the demand and supply economics or knowledge and commercial economies, and encapsulates the various role players as defined in the framework as illustrated in Figure 2.4 above.

2.2.2. DEFINING AN INNOVATION SYSTEM

As briefly discussed earlier, the innovation system can be defined as the planned process of innovation in a given environment (OECD, 1997). The concept coincides historically from the work of authors such as Friedrich List (1841), Bengt A. Lundvall (1985) and Christopher Freeman (1988 & 1995) and was originally applied from national innovation systems for economic development to regional, local, technological and sectoral innovation systems. In theory, the innovation system is the process through which innovation is commercialised in a particular environment made up of the complex relationship between businesses, universities and research institutions of the innovation ecosystem in that particular country.

The national innovation system and policies are generated by the government of the country and subsequently should work well with various governing bodies and organisations both internationally and nationally to define the system (Reichelt, 2007). The policies should help develop the innovation ecosystem and give support to the lower ordered innovation systems. The national innovation system can, therefore, be seen as the masterplan with actionable plans for each region, local community, particular technologies and sectors.

2.2.3. THE INNOVATION VALUE CHAIN

The innovation value chain is regarded as a critical part of the innovation system as it prescribes a logical process or system to follow in developing innovation. The two most well-known innovation value chain models are by Hansen & Birkinshaw (2007), and by Roper *et al.* (2008). Their models will be discussed in more depth in Chapter 3. For this subsection, the innovation value chain with regards to the innovation system and process of commercialisation for universities and research organisations will be discussed.

It should be clearly stated that not all sources of innovation derive from research as the various models would portray. This section and paper will not discuss in depth the various tools and techniques regarding ideation and sources of innovation. The depiction should also not preclude the emergence of 'curiosity-driven research' that is unrelated to social or market needs (Wessner, 2004). However, Stokes (1997) argues that industry, market and social needs are the primary source of various questions and problems worthy of research.

When considering a basic linear value chain model to explain the logical process by Hansen & Birkinshaw (2007) of idea generation to idea conversion to idea diffusion makes sense. It requires, however, a more in-depth investigation to evaluate the real system and the dynamics that play a vital role. According to the GII (2013) report, an innovation hub would install the following value chain as illustrated by Figure 2.6 below. The value chain clearly shows that research and development are followed by commercialisation and then business operations.

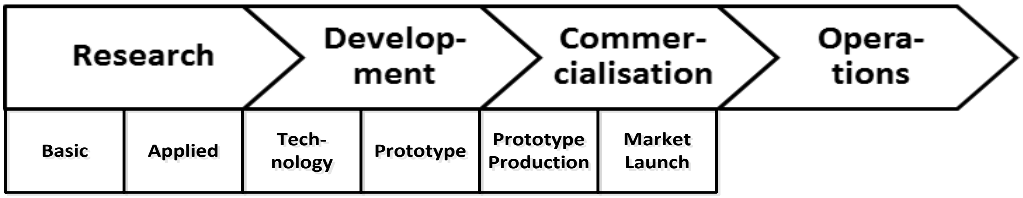

Figure 2.6: The Innovation Hub Value Chain adopted from GII (2013)

This innovation value chain can be further defined as stages of development through the value chain which can also be defined as a more traditional innovation value chain. These stages are described in Table 2.1 below.

Table 2.1: Technology Stages of Development of the Innovation Value Chain[3]

Development Stage Description	Characteristics of the Stage of Development	Phase of Value Chain
Basic Research (also known as fundamental or pure research)	*Is defined as the search for basic understanding of new knowledge or fundamental ideas or aspects of phenomena through a systematic study without thinking of any specific application or products.*	*Research*
Applied Research	*Is defined as using scientific methods or systematic investigation to evaluate the practical application of science. It uses practical problem-solving techniques and often employs empirical methods. Since it resides in the complexity of real world, transparency is a key emphasis.*	*Research*
Early Research (Technology or Intellectual Property) Development	*Is defined as the process for validating the first initial proof of concept of the research and generally only requires additional reproducibility validation.*	*Development*
Late Research (Technology or Intellectual Property) Development	*Is defined as a further process for validating the partial proof of concept of the research and generally involves validating the reproducibility of the research.*	*Development*
Validation	*This stage is only applicable in certain unique situations where further validation is required or when the research development is not satisfying enough.*	*Development*
Early Prototype Development	*Is defined as the initial prototype developed to demonstrate key environmental and functional use.*	*Commerciali-sation*
Late Prototype Development	*Is defined as the full developed prototype that is capable of demonstrating the full environmental and functional use.*	Commerciali-sation
Early Commercial Application	*Is defined as the initial customer or environmental feedback for developing a commercial use and strategy.*	Commerciali-sation
Market Launch	*Is defined as the launch of the innovation in its full commercial environment setting.*	Commerciali-sation
Production Scaling and Distributions	*Is defined as the process of business optimisation and scaling the production to drive distribution and sales or use.*	Operations

The important aspect to remember is that these concepts run parallel to the development of a commercial entity and processes. It is clear that the innovation process is not just a simple linear model and requires iterative feedback loops to continually innovative and respond to the high risk of uncertainty.

3 *The stages of technology development of the innovation value chain were compiled in the table form from consulting various sources such as Branscomb & Auerswald (2002), Wessner (2004), Hansen & Birkinshaw (2007), Roper et al. (2008) and GII (2013).*

A discussion paper on entrepreneurship and the innovation ecosystem by Wessner (2004) argues the role of universities clearly and provides us with a nonlinear model of the innovation value chain (refer to Figure 2.7 below). This model gives a more iterative and continuous learning approach as he argues that trial and error advances the learning process. He also states that "too many good ideas do not make it to the market" as the process from "research to innovation to commercialisation involves consecutive challenges and market signals that can often be indistinct or even absent".

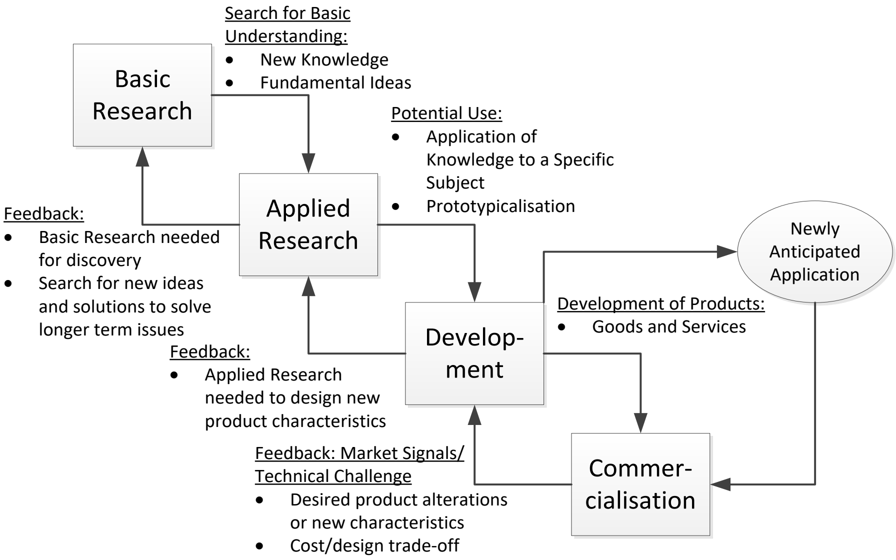

Figure 2.7: A Non-Linear Innovation Value Chain Model adopted from Wessner (2004)

Another model to consider is the sequential model of development and funding by Branscomb & Auerswald (2002) as illustrated in Figure 2.8 below. The interesting aspect about this model is the relationship between the invention and innovation process and what seems to be the lack of funding available at *"Early-Stage Technology Development"* stage. However, to point out exactly at which stage research and development are invested in could be impossible as large flows of investments in recent times have been made in companies with little, if any, technologies under development. This leaves the model to serve purely as a conceptual model and to give a rough idea of how funding relates to the sequential stages with potential funding gaps.

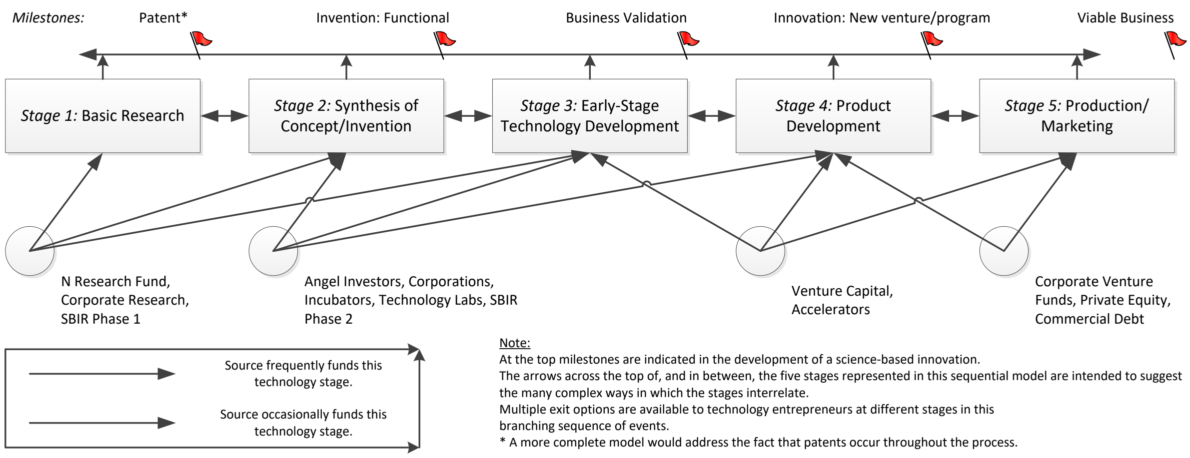

Figure 2.8: The Sequential Model of Technological Development and Respective Funding adopted from Branscomb & Auerswald (2002)

The role of having an innovation value chain is to ensure that all parties understand the generalised process for logically developing a technology or intellectual property. The importance of maintaining an innovation value chain in an innovation ecosystem relays on avoiding growth gaps in the process. This requires that the various stages are maintained to ensure a strong ecosystem while the following aspects are to be considered to avoid any potential growth gaps (GII, 2013):

- Capital markets and business expertise and services with enabled structures for efficient access;
- Strong intellectual property protection and services with enabled structures for efficient access;
- R&D require self-sustainability through human and knowledge capital support in the ecosystem;
- The ecosystem is in itself a brand and requires a unique value proposition to attract human capital, (both international and national talent);
- The ecosystem needs to help supply both internal and external market demands;
- A strong network of multiple independent stakeholders should form the human capital (e.g. academics, corporate organisations, entrepreneurs, researchers and venture capitalists);
- Develop a strong regulatory and legislation environment for businesses, especially to support and promote new start-up business creation.

2.2.4. TECHNOLOGY CYCLES AND THE VALLEY OF DEATH

The concept of product life cycles seems to have originated in the late 1950s or early 1960s, and has been much discussed in literature relating to competitive advantage and business strategy (Levitt, 1965; Polli & Cook, 1969; Klepper, 1996). The term product or technology life cycle (TLC) relates to the commercial gain a business supposedly has from spending on R&D to later gain in the maturity phase when the technology or product has gained market share. This theoretical and conceptual model specifically relates to research and development and how a business can use technology to develop (refer to Figure 2.9 below).

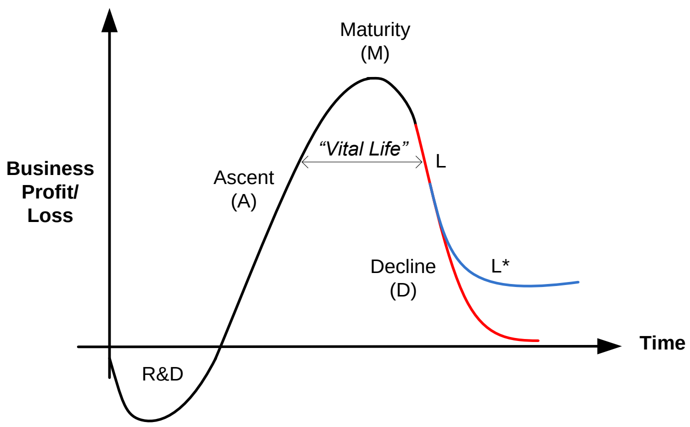

Figure 2.9: The Technology or Product Life Cycle adopted from Levitt (1965), Polli & Cook (1969) and Klepper (1996)

The TLC is broken up into five main phases, the research and development, the ascent phase, the maturity phase and the decline phase.The following phases are defined as follows:

- ***Research and development (R&D):*** This phase involves high risk both for the technology and the commercial business as investments are made into researching and developing a new invention.
- ***Ascent phase (A):*** This phase involved the invention (whether product or service) being market ready, launched in the market and successfully accepted in the market. The invention is being commercialised, and the key importance is scaling and leveraging the new competitive advantage to gain market share.
- ***Maturity phase (M):*** The innovation is adopted by general population, and the market share gets diluted with increased competition. The business growth slows down as a competitive advantage slowly becomes normalised.
- ***Decline phase (D):*** In this phase the market size starts to decrease as new technologies and innovation provide the market with better utility and potential value. The business either continues till zero margins or loss is made or a strategic change is made to develop and commercialise new technologies and innovation.
- ***Continued R&D phase (L*):*** Continued learning and innovating businesses will use profits gain and reinvest in new technologies to ensure that the business remains competitive and sustainable. This relates to strategic change management and innovation ensures continued growth.

It must be made clear that the TLC relates to the business profits or losses in the process of developing technology; it doesn't however consider the adoption of the technology in the market and other competition. The hype cycle (market trend) is used in practice to give a more in-depth snapshot of the relative maturity of technology and can give a better understanding of how technology can be exploited and how it is adopted (Fenn, 2010). The hype cycle can generally be broken up into five sections and is measured by the visibility of the technology in the market to the maturity over time of the technology (refer to Figure 2.10 below).

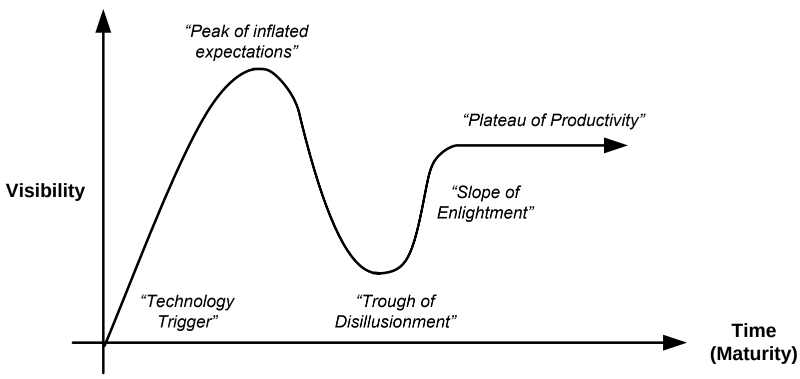

Figure 2.10: The Hype Cycle adopted from Tully (2011)

The hype cycle's sections are defined as follows (Tully, 2011):

- ***'Technology Trigger':*** Is where early technology breakthroughs are made and a possible proof of concept, but often no prototype developed or commercially viable product as of yet. Early success stories, publications and media articles increase visibility as the 'hot technology' of the future market.
- ***'Peak of Inflated Expectations':*** A number of early publications produce various success and failure stories and media articles which some companies act upon while others don't.
- ***'Trough of Disillusionment':*** Some experiments, prototypes and implementations fail. The producers of the technology either fail or improve their products satisfying early adopters and convince investors to continue investments.
- ***'Slope of Enlightenment':*** The technology's value proposition starts crystallising for the business, and its benefits become better understood. New product prototypes and generations are developed while the business invests more in the product line. Some businesses remain conservative in this stage steering caution into the wind with their investments.
- ***'Plateau of Productivity':*** A mainstream of the market stream is starting to adopt the technology. The technology's viability is clearly assessed by the provider while the broad market application and relevance to the users are clearly defined.

Another cycle that has a strong correlation to the hype cycle is the technology adoption cycle, also known as the 'Crossing the Chasm' cycle which conceptually highlights the way consumers embrace new technology or innovation (Moore, 1999). Similar to the TLC and hype cycle model, the TAC is separated in phases (the innovators, early adopters, early majority, late majority and the laggards). To illustrate this conceptual understanding, refer to Figure 2.11 below which combines the hype cycle diagram with the TAC.

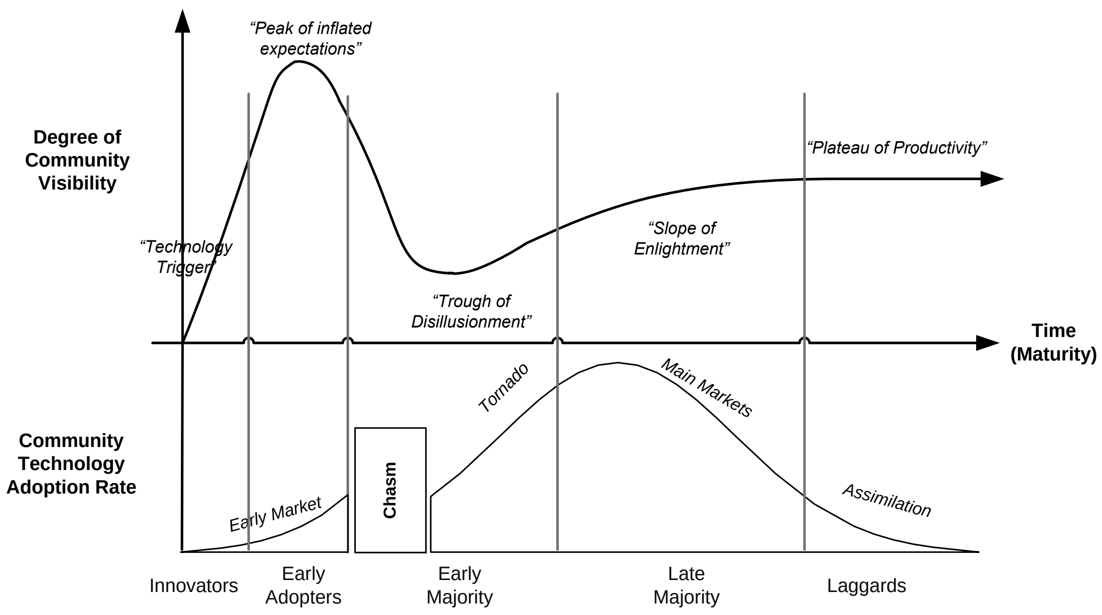

Figure 2.11: The Hype Cycle Combined with the Technology Adoption Cycle adopted from Moore (1999) and Tully (2011)

In the TAC model by Moore (1999) sections are defined as follows:

- ***Innovators:*** Are at the high-risk side of technological developments (usually in a specific sector or industry), adopting new ideas and concepts into inventions and possible innovations. This is a small demographic of the population and is usually leading and cutting-edge-minded people particularly interested in a specific sector or industry.
- ***Early Adopters:*** Are also on the high risk of technological developments and adoptions, usually the first to adapt and follow the innovator's new ideas or concepts. Similarly, they are a small demographic of the population and usually tend to be highly educated and young individuals.
- ***Early Majority:*** These are a larger demographic of the population, open to new ideas and concepts, but usually wait for more market acceptance before investing themselves.
- ***Late Majority:*** These are a large demographic of the population that are more risk conscious and conservative individuals. They require more convincing before investment will be made, but are a great potential demographic of customers.
- ***Laggards:*** These a smaller demographic of the population that are more frugal and conservative, usually uneducated and older individuals that avoid risks and only invest in well-established technologies and ideas.

Taking these three models into consideration, businesses need to consider a diverse investment portfolio, the scalability of the R&D investments, the life cycles of the technology and the business, the customer adoption cycles, and the return on investments. After Moore's first book in 1991 (revised in 1999) called '*Crossing the Chasm*', he wrote another book in 2005 called '*Dealing with Darwin*'. In this book, he extends the TAC model to the Category-Maturity Life Cycle model which is differentiated by the different innovation types that play a dynamic role in economic markets (Moore, 2005; Du Plesis, 2009). This model will not be discussed in further detail as its understanding diverges off track with the goals intended for this chapter.

The importance of these models is to leverage a good conceptual understanding on possible growth gaps throughout the life cycle whether it be a business or a technology. Namely, it is well known in literature as the 'chasm' (Moore, 1999) or the '*valley of death*' which is a growth gap that doesn't allow technology necessarily to transition into commercialisation. As Wessner (2004) said, "*many good ideas perish on the way to the market*". This becomes a challenge to obtain capital for a new business while the technology is still imperfectly understood and is of too high-risk with no validated commercial potential in essence. The term 'chasm' or '*valley of death*' can therefore be described as the "period of transition when a developing technology is deemed promising, but too new to validate its commercial potential and thereby attract the capital necessary for its development" (Wessner, 2004). Overcoming these obstacles is complicated and requires an understanding of the reward system investors operate under, as all technologies and inventions need to translate into return on investment which is difficult to compare to fundamental research discoveries (Jackson, 2011).

In Jackson's (2011) model of the innovation ecosystem, she developed a clear conceptual illustration of the '*valley of death*' that exists within the innovation ecosystem. She highlights that not only does research face the challenge of financial restrictions, but also the challenge of scarce implementation resources for prototyping and development. The stakeholders involved in the process of innovation transitioning through the '*valley of death*' are academia (researchers), entrepreneurial start-up businesses, investors (e.g. venture capitalists and angel investors), and commercial industry.

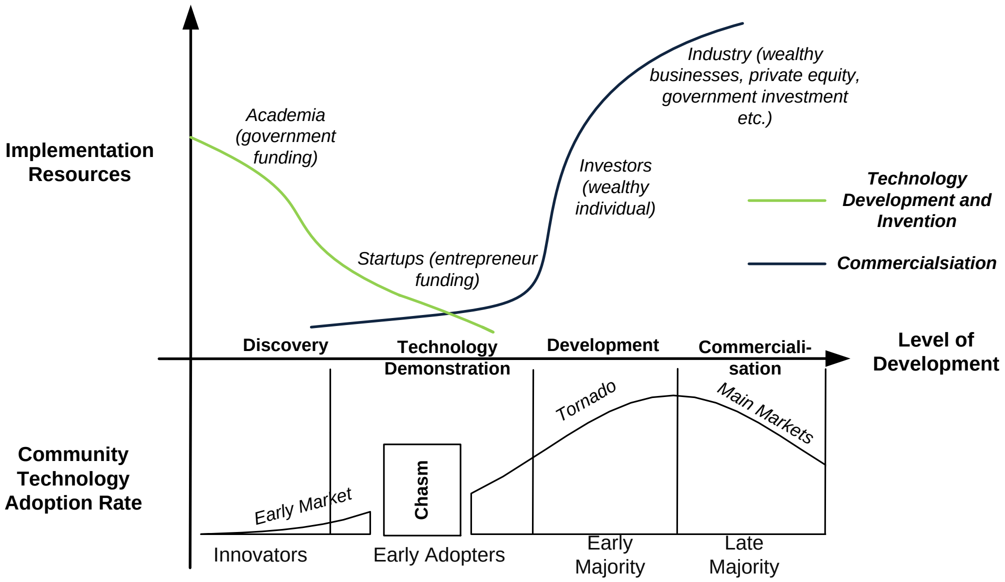

Figure 2.12: The Valley of Death in the Innovation Ecosystem adopted from Jackson (2011)

After defining the 'valley of death', or 'chasm', it is important to understand more specifically the general gap and what is causing this gap in the innovation cycle. In the research done by Bendis & Byler (2009), a national innovation framework was developed specifically to enable and encourage innovation. They not only argued the positive impact of an innovation system on the economy, but also illustrated the gap caused by the 'valley of death' in the United States of America (USA). This gap generally comes in the form of innovation capital which is illustrated in Figure 2.13 below. While there exists an innovation gap in the USA, it doesn't stop there. In a Global Entrepreneurship Monitor survey, it was reported by 52% of the entrepreneurs globally that there is sufficient capital to grow their start-up business in their ecosystem, but only 37% of entrepreneurs said that there is enough seed capital (Vogel, 2010).

The innovation capital gap exists when investments are most required, but least available for the commercialisation of innovative products and/or services. In other words, start-up businesses struggle to scale their business into larger markets and cannot entice limited investors who are generally found in pre-seed, seed and early start-up stages. Investors are wary of the high-risks associated with start-up businesses at those stages and due to longer commercialisation time cycles and lack of risk mitigation at the early stages. The first funding gap often translates into a secondary funding gap (Bendis & Byler, 2009) causing numerous start-up businesses to liquidate due to lack of capitalisation options. More emerging economies that have a less-developed ecosystem, can have more funding gaps.

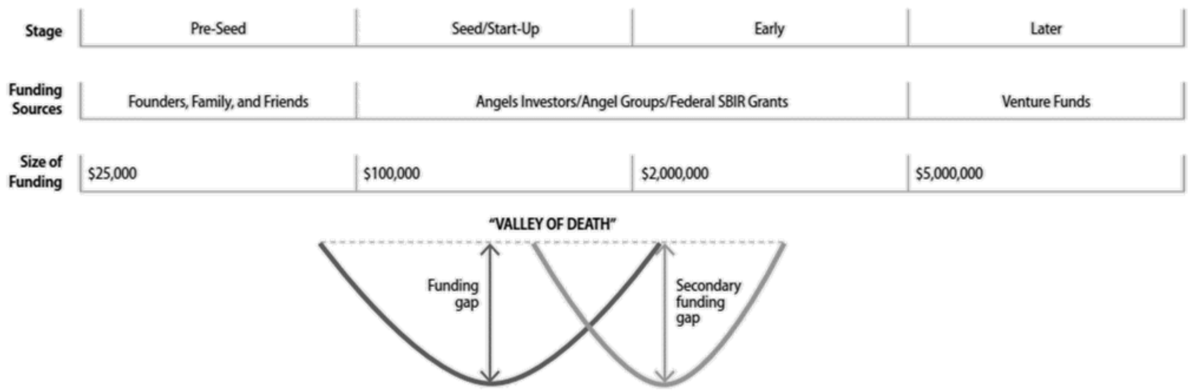

Figure 2.13: The Innovation Capital Gap ('Valley of Death') adapted from Bendis & Byler (2009)

It is also noteworthy to understand that the USA has the strongest start-up ecosystem, in the Silicon Valley, (Marmer, et al., 2012) and also has a strong national innovation ecosystem (Cornell University, INSEAD and WIPO, 2013), but there are still innovation capital gaps. However, this is understandable considering the geographical vastness of the USA.

2.2.5. COMMERCIALISING CHALLENGES

The definition of commercialisation seems to be dispersed in its exact meaning and the process to follow. According to the online Cambridge Dictionary[4], commerce is defined as the "*the process of making a product or service available for sale to the public*" and therefore commercialisation is the "*the process of developing or organising something in order to make as much money as possible*". This is similarly aligned to the definition of NNMU (2010) which defines commercialisation as "*the process of converting science and technology, new research or an invention into a marketable product or industrial process*".

However, the process of commercialisation is far easier said than done. This is because of the numerous commercialisation challenges that organisations and countries face. In particular, the 'valley of death' is an area of high risk for investors, and it is important to remember who would be providing the capital. Due to the fact that investors would be providing the capital necessary for the development of the technology or intellectual property, they have the bargaining hand and the inventor or entrepreneur needs to fulfil their requirements if they ever wish to see the investment. Investors open to high-risk opportunities would want as much as possible of that risk to be mitigated (simple good business practice) as well as make a certain return on the investment.

It is also important to understand that not all intellectual properties are aligned with investors' requirements as of the nature of the research that is done by universities and research institutions. According to Abbas (2013), basic research and applied research doesn't necessarily have commercial value. In the case of basic research, the researcher's objective is to expand his personal knowledge and not necessarily to invent or to create

[4] Online Cambridge Dictionary definition of *Commercialisation*. [Online] Available at http://dictionary.cambridge.org/dictionary/business-english/commercialization [Accessed on 8 March 2014]

something new, while the applied researcher's objective is to solve practical problems that "*will improve human conditions and make the world a better place*" (Abbas, 2013).

In the GII (2013) report, common challenges were described, and suggestions were given on how research institutions and universities can improve the efficiency of the innovation input and output. They are as follows:

- Improving efficient use of the various innovation inputs;
- Increase the innovation output;
- Improve intangible assets creation through strategic alignment;
- Improve on innovation networks and linkages;
- Improve the development of intellectual property with more market alignment (venture capital investments are almost non-existent);
- Improve intellectual property's market sophistication to correspond to the requirements of innovation promotion.

When looking from a university perspective, Laperche (2002) defined that legislation, university strategy, technical progress and, economic environment and entrepreneurship are four important factors in commercialising research for a young university. He calls it the organic paradigm of commercialisation of research and is illustrated in Figure 2.14 below.

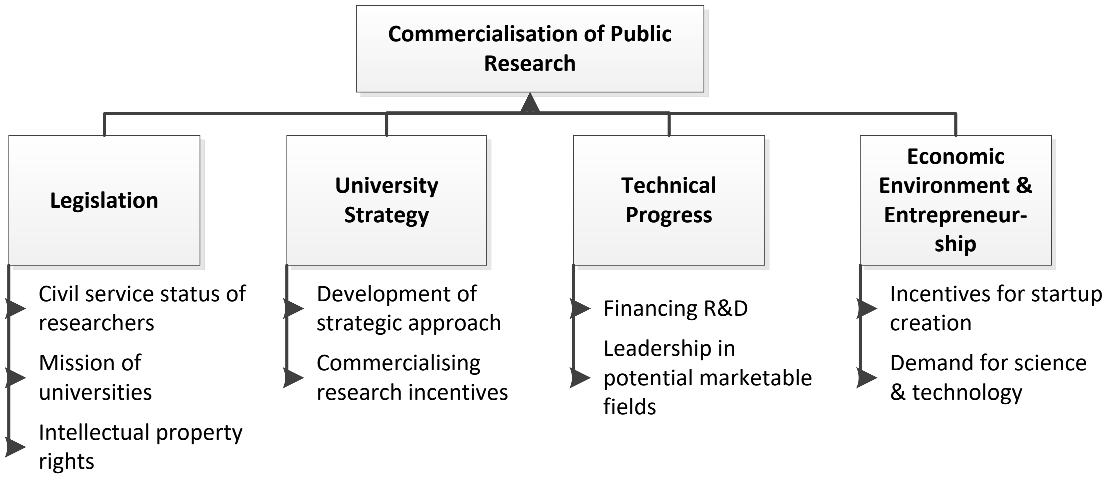

Figure 2.14: The Organic Paradigm of Commercialisation of Research adopted from Laperche (2002)

The four factors of commercialisation are defined in more detail as follows:

- **Legislation:** The legislation governs numerous aspects, but the most important aspects are the legislation that governs the mission of the university, the researcher's scope of possible commercialising research, and also the concerns regarding the intellectual property rights protecting the innovators.
- **University strategy:** It is of great importance that the institution defines a specific strategy to capitalise on assets, producing high-quality research and education, and to develop a strong network of industry partners to further the commercialisation process.

- **Technical progress:** This is the trend of R&D financed and creating leadership possibilities in the market through commercialising research. This involves financial and resources support towards the R&D and the commercialisation process.
- **Economic environment and entrepreneurship:** From a macroeconomic perspective a culture of innovation and entrepreneurship needs to be created through incentives for human capital investment, for being an entrepreneur, for existing businesses to grow (e.g. tax incentives and available finances), and for flexible labour markets.

2.2.6. TECHNOLOGY TRANSFER OFFICES

Most universities, research institutions and even private organisations make use of technology transfer offices (TTOs) to support their innovation process. Their role is to enable and facilitate the process of taking IP and technology to outside entities for commercialisation (Reichelt, 2007). In the case of commercialising research of Public funded universities and research institutions, TTOs will internally manage research at the organisation, assist in the intellectual property strategy and protection, and will also assist in the intellectual property or technology transfer (e.g. licensing) between the organisation and the commercial entity (NMMU, 2010).

Besides the direct commercialisation process, an indirect process is the knowledge sharing of universities which could also serve in some cases as additional revenue streams. These interactions or knowledge sharing from academia to industry are on the following platforms (Debackere & Veugelers, 2005):

- Graduate exchange programmes;
- Graduate education co-operation;
- Organisational staff advanced training programmes;
- Publications and conference papers;
- Researchers partake in periodic exchanges between different research institutes and businesses;
- Consulting research;
- Various other informal exchange types.

The university or organisation will have their own model, but the standard practice to commercialise public research is as follows (NMMU, 2010; Visser, 2011, and Laperche, 2002):

- ***Licensing agreement contracts***: agreements between the university and a specific or multiple industry partners giving them the intellectual property authorisation in exchange for financial compensation usually within a given expiration date. This could also include compensations for patents filed for a specific licence.
- ***Research contracts***: is a formal agreement between the university and an industry partner for the university to research a certain field(s) in return for compensation. This could also include compensations for patents filed for a specific licence.
- ***Spin-off or start-up businesses:*** the university researchers establish a start-up business whereby the university has an equity stake or as a result of the business licensing technology from the university.

It is important that all universities benchmark their performances and a good indication of a university's innovation output is measured by evaluating their TTO. It is seen that on average TTOs will partake in far more licensing agreements and research contracts than the amount of start-up businesses that are formed in a calendar year (Heher, 2007). This is because of the limited financial support available and the associated high risks involved with start-up businesses, but with high risks come high rewards.

2.2.6.1. STRUCTURES OF TECHNOLOGY TRANSFER OFFICES

Technology transfer is in essence an institutional evolution starting at traditional '*pure*' academic universities evolving to more entrepreneurial universities. The internal institution evolution evolved over three phases:

(1) The first phase was research offices, providing support and services in the terms of competitive grant processes, external funding required for research, grant administration and data management.

(2) Secondly, were sponsored research or industrial liaison which was a contract negotiated research by industry on solving their problems and provided universities with additional external funding.

(3) The third phase was TTOs incorporated IP management which served as an additional revenue stream for the universities.

Different models and structures have different propositions and depending on the context in terms of the research capacity of the university, environment, skills and funding available, would determine the optimal model and structure (Bercovitz, et al., 2001). According to Markman *et al*. (2004), the success of a TTO is critically dependent on the structure of the transfer process. The key aspects regarding the TTO structure are the reporting hierarchy relationship with regards to decision-making and the extent of functional autonomy (Visser, 2011). However, Mansfield (1995) and Friedman & Silberman (2003) argued the importance of the university's physical geographical location with regards to resources, infrastructure, financing and industry partners also playing a vital role.

NMMU (2010) argues that there is an infinite variety of models and structures for university TTO's; seven important TTO structures are described in more depth below. The first three were defined by Visser (2011) and the remaining four structural form configurations were characterised by Chandler (1962, 1977 & 1990):

- **Traditional University Structure:** This TTO structure runs as a university department usually falling under the budgetary obligations of the university's research division and the authority of the vice-chancellor (or vice-rector) of research and innovation. The TTO staff consists of untenured university staff whose performance is monitored by the university administration department. By keeping things in-house, they reduce costs, but the TTO manager's decision-making ability is duly limited. The main objective of this traditional TTO structure is to regenerate the revenue through pursuing conventional licensing opportunities.
- **Non-Profit Research Foundation:** This TTO structure runs as a separate business unit outside the university with their own Board of Directors while usually the vice-chancellor (or vice-rector) would be the chairperson. The main advantages are that the TTO has a more flexible structure regarding incentives and

licensing strategies while having full budgetary autonomy. Additionally, the university's liability is limited with regards to its technology licenses towards lawsuits from licensing disputes, intellectual property infringements and future liabilities.

- **For-Profit Private Extension:** This TTO structure runs as an independent business unit outside the university with their own Board of Directors and Chief Executive Officer (CEO). The TTO's staff is usually made up of personnel with experience in business development, intellectual property law and venture capital acquisitions. The main advantages are that the TTO has a more flexible structure regarding incentives, distribution formulas and licensing strategies while having full budgetary autonomy. Similar to non-profit research foundations, the university's liability is limited. The private extension is also more conducive generating spin-off or start-up businesses.
- **Unitary Form Structure:** This TTO structure is similar to the traditional university TTO structure with a strong hierarchy giving the university administration the decision-making authority.The top management of the university administration defines the vision, goals and strategy as well as supervising and coordinating the performance of the TTO's different functional units.
- **Multi-divisional Form Structure:** This TTO structure consists of a central TTO that supervises and coordinates the TTO's different divisional units. The TTO's hierarchy can be decomposed into divisional units such as products or technology, intellectual property, geographic functions and marketing. This structure operates together with the university in a semi-autonomous decision-making environment as the top management of the university is usually part of the hierarchy structure of the TTO.
- **Holding Company Form Structure:** This TTO structure consists of a holding company with divisional structures similar to the multi-divisional structure, but with less autonomy and a weaker central TTO office.
- **Matrix Form Structure:** This TTO structure consists of an integrated system where the TTO's functional and product operations run simultaneously. The hierarchy structure then forms part of a sub-unit supervising and coordinating the multidimensional functions and allows for a more semi-autonomous decision-making structure.

Bercovitz *et al.* (2001) suggests that the different TTO structuring options all have underlying predictable effects on the coordination capabilities of the organisation, the incentive alignment and the capacity for information processing. The key importance is as mentioned above, to align the university strategy and the objective of the commercialising programs with the appropriate TTO structure (Markman, et al., 2004). In a broad sense, the following challenges that TTOs face further add to the alignment of choosing the correct TTO structure (NMMU, 2010):

- Funding regime changes;
- Universities and university systems change to accommodate social demand changes;
- New innovation and research best practices are developed;
- Expanding network of collaboration between universities, government, industry and society.

2.2.6.2. TTOs' RESPONSIBILITIES AND CHALLENGES

The role within the innovation system and value chain can clearly be seen as an interface between different stakeholders and role players in the commercialisation process of innovation. They manage both internally between university management and researchers, and externally between the university and other universities, research organisations, government and industry partners.

The WIPO (2005) defines different roles for TTOs at a national and university level. At the national level, WIPO defines the following actions that help define the roles and requirements of technology transfer of intellectual property:

- Efficient intellectual property management system;
- Legal status of the university;
- Apparent and transparent intellectual property ownership policies;
- Different research funding agencies and organisations;
- Different intellectual property protection funding and/or discounts;
- Commercialisation of inventions and intellectual property regulation and requirements;
- Public interest protection and safeguarding;
- Best practice guidelines;
- Establishment of supporting programmes technology transfer;
- Intellectual property education programmes;
- Framework for establishing spin-off or start-up businesses from university intellectual property;
- Seed funding support for establishing spin-off or start-up businesses from university intellectual property;
- Grace periods for research and spin-off or start-up businesses.

While the WIPO (2005) defines similar actions, at university level, that will help define the roles and requirements of technology transfer of intellectual property:

- Apparent and transparent intellectual property policies;
- Clear intellectual property ownership criteria;
- Clear revenue distribution and/or royalty sharing regulations;
- Clear regulations and management of conflicts of interest;
- Intellectual property administration responsibility policy;
- Researchers and university obligations;
- Sponsored research contracts and agreements;
- Career and intellectual property advancements;
- Management and regulation of spin-off or start-up businesses.

In an article by Polt *et al.* (2001), they found that TTOs managing networks of industry, government and research partners are very often limited by the size of the TTO itself. Even though some TTOs still outperform and succeed, they distinguished the success factors that can be seen as further requirements for TTOs to be more effective and successful:

- Combine research teams to focus on basic and applied research;
- Regular research strategy audit to align the research with the changing economy and society;
- The TTOs geographical position and proximity to the researchers;
- Available resources and infrastructure enabling effective research (e.g. proof of concept infrastructure, access to commercial contract lawyers, intellectual property management, spin-off and start-up business development and access to funding);
- Attractive remuneration packages promoting successful intellectual property transfer and creation of spin-off or start-up businesses.

There are most certainly other roles and additional services that are not mentioned such as business plan development and entrepreneurial workshops that add to the effectiveness and performance of a TTO. The main objective of the TTO remains the same as the interface between industry, government and the university to support the commercialisation of university intellectual property (Visser, 2011).

2.2.6.3. BENCHMARK PERFORMANCE

In a report by Heher (2007), an extensive study on the benchmarking of TTOs across developed countries such as the Australia, Canada, UK and USA based on data for the years 2001 to 2003, was then translated into accepted standards for developing countries to strive towards. The typical averaged international research, and innovation outputs are summarised in Table 2.2 below with the value ranges per US$100 million adjusted research expenditure (*ATRE*). The typical TTO patent budgets also differ in direct proportion to the size of the university which can range for USA universities between 0.2–0.5% (0.5–1% for UK universities) of the total research expenditure for a large university, to 1–2% (2–3% for UK universities) in small universities.

Table 2.2: International TTO Performance Benchmark Summary adapted from Heher (2007)

Category	Performance Benchmark	Notes
Invention Disclosures	40–60	*Per US$100 million ATRE*
Patents	20–30	*Per US$100 million ATRE*
Licences	10–15	*Per US$100 million ATRE*
Spin-off Companies	1–5	*Per US$100 million ATRE*
Income	US$1–US$3 million	*1–3% of research expenditure.*
Patent Budget	1–2% of total	*As % Income*
Size of Staff	4–20	

In terms of average returns from technology transfer activities, it is fascinating to note that in the UK and Australia, only the top 5% of all universities are profitable. Though better, similar frightening figures represent the US and Canada, TTO performances as a top 50–95% of the universities are reaching break-even to profitable while the top 5% are very profitable. Heher (2007) estimates that TTOs normally reach profitability after 12 years of technology transfer activities through the accumulative income.

2.2.7. ENTREPRENEURIAL UNIVERSITIES AND START-UP BUSINESSES

In the history of universities, there have been a few drastic transitions of the university mission over the past few centuries. According to Etzkowitz (2003), universities' original mission was for tertiary educational teaching (also known as the Teaching University) which involved "*preservation and dissemination of knowledge*". Universities then underwent a first transition where the mission involved teaching and research, where universities are known as the Research University (Slaughter & Leslie, 1997; and Etzkowitz, 2003). The second transition was the transformation of the university mission into teaching, research and economic development, where universities are known as the Entrepreneurial University (Slaughter & Leslie, 1997; and Etzkowitz, 2003).

There have been various attempts in the literature to define the exact definition of an Entrepreneurial University, but there is no consensus (OECD, 2012). In Table 2.3 below, the various definitions of an Entrepreneurial University founded in the literature as well as considering the best definition of an Entrepreneurial University. From the various definitions, key drivers for these transitions are also debated in the literature and their effect on each other forms the basis of the various theories. In literature, the following three common drivers for these transitions were found (Etzkowitz, 2003, and NMMU, 2010):

- Government reduced expenditure on research and development, and university budgetary constraints subsequently forces universities to find alternative revenue streams for sustainability;
- The universities' role in regional and national innovation, and economic development;
- The tertiary education sector is becoming more professionalised.

Table 2.3: Definitions of an Entrepreneurial University adapted from Guerrero (2007), Kriby *et al*. (2011), and OECD (2012)

Author	Year	Definition
Etzkowitz	1983	*"Universities that are considering new sources of funds like patents, research funded by contracts and entry into a partnership with the private enterprises".* (p. 198)
Chrisman, Hynes & Fraser	1995	Entrepreneurial Universities involves *"the creation of new business ventures by university professors, technicians, or students."* (p. 268)
Dill	1995	*"University technology transfer is defined as formal efforts to capitalise upon university research by bringing research outcomes to fruition as commercial ventures. Formal efforts are in turn defined as organisational units with explicit responsibility for promoting technology transfer."* (p. 370)
Clark	1998	*"An Entrepreneurial University, on its own, seeks to innovate in how it goes to business. It seeks to work out a substantial shift in organisational character so as to arrive at a more promising posture for the future. Entrepreneurial Universities seek to become 'stand-up' universities that are significant actors in their own terms."* (p. 7)
Röpke	1998	*"An Entrepreneurial University can mean three things: the university itself, as an organisation, becomes entrepreneurial; the members of the university (faculty, students , employees) are turning themselves somehow into entrepreneurs; and the interaction of the university with the environment, the 'structural coupling' between university and region, follows entrepreneurial pattern."* (p. 2)
Subotzky	1999	*"The Entrepreneurial University is characterised by closer university-business partnerships, by greater faculty responsibility for accessing external sources of funding, and by a managerial ethos in governance, leadership and planning."* (p. 402)

Author	Year	Definition
Kirby	2002	*"As at the heart of any entrepreneurial culture, Entrepreneurial Universities have the ability to innovate, recognise and create opportunities, work in teams, take risks and respond to challenges."* (p. 2)
Etzkowitz	2003	*"Just as the university trains individual students and sends them out into the world, the Entrepreneurial University is a natural incubator, providing support structures for teachers and students to initiate new ventures: intellectual, commercial and conjoint."* (p. 112)
Williams	2003	*"Is nothing more than a seller of services in the knowledge industry*." (p. 14)
Jacob, Lundqvist & Hellsmark	2003	*"An Entrepreneurial University is based on both commercialisation (custom-made education courses, consultancy services and extension activities) and commoditisation (patents, licensing or student owned start-up businesses)."* (p. 1555)
Guerrero-Cano, Kirby & Urbano	2006	*"...Entrepreneurial University is defined as a university that has the ability to innovate, recognise and create opportunities, work in teams take risks and respond to challenges (Kirby, 2002), on its own, seeks to work out a substantial shift in organisational character so as to arrive at a more promising posture for the future (Clark, 1998). In other words, is a natural incubator, providing support structures for teachers and students to initiate new ventures: intellectual, commercial and conjoint (Etzkowitz, 2003)."* (p. 307)
Thorp & Goldstein[5]	2010	*"... the Entrepreneurial University does embody these characteristics: it recognises that liberal arts education has fueled American innovation; it thrives on big problems; it values both innovation and execution; and it places culture ahead of structure; It encourages partnerships between academics and entrepreneurs."*
OECD	2012	*"... the definition of an Entrepreneurial University is informed by:* • *the institutional environment: processes/systems policies, practices, culture, leadership.* • *the employees/people: entrepreneurial spirit, rewards/incentives, support/development, role models.* • *the students: opportunities, engagement, networks/contacts, learning by experience and failing.* • *the impact: effect on the institution and its people, on graduates, on stakeholders, on wider community and ecosystem."* (p. 44)

The Entrepreneurial University started in the country, USA when the Massachusetts Institute of Technology (MIT) in 1862 was founded as a '*land grant*' university (Etzkowitz, 2003). Additionally, Etzkowitz uses the University of Stanford[6] as the base case for the transition to an Entrepreneurial University in the mid-twentieth century. He defines the key elements to include as follows:

- The organisation of the group research to create research that has commercial potential;
- Organisational systems that allow the movement of commercial research across institutional borders;
- An integration framework of university and industry partners with common objectives to commercialise the intellectual property.

[5] Derived from the online summary: Throp, H. & Goldstein, B., 2010. *Inside Highered: The Entrepreneurial University*. [Online] Available at: http://www.insidehighered.com/views/2010/09/27/thorp [Accessed 23 March 2014]

[6] *According to the Start-up Ecosystem Report (2013), the Silicon Valley is ranked first with extensive support for the commercialisation of intellectual property and technology with numerous commercialising agents surrounding the University of Stanford* (Marmer, et al., 2012). *Furthermore, the USA's innovation output according to the GII (2013) is tied at first with Switzerland (Cornell University, INSEAD and WIPO, 2013). This makes Stanford University a perfect case to base any logical argument regarding an Entrepreneurial University.*

The OECD (2012) in a report with the European Commission, developed a Guiding Framework for Entrepreneurial Universities which is based on their definition of an Entrepreneurial University that encapsulates the existing and available literature and models (refer to Table 2.3 above). Their framework consists of Leadership and Governance; Organisational Capacity, People and Incentives; Entrepreneurial Development in Teaching and Learning; Pathways for Entrepreneurs; University-Business/external Relationships for Knowledge Exchange; the Entrepreneurial University as an International Institution; and Measuring the Impact of the Entrepreneurial University (refer to Figure 2.15 below).

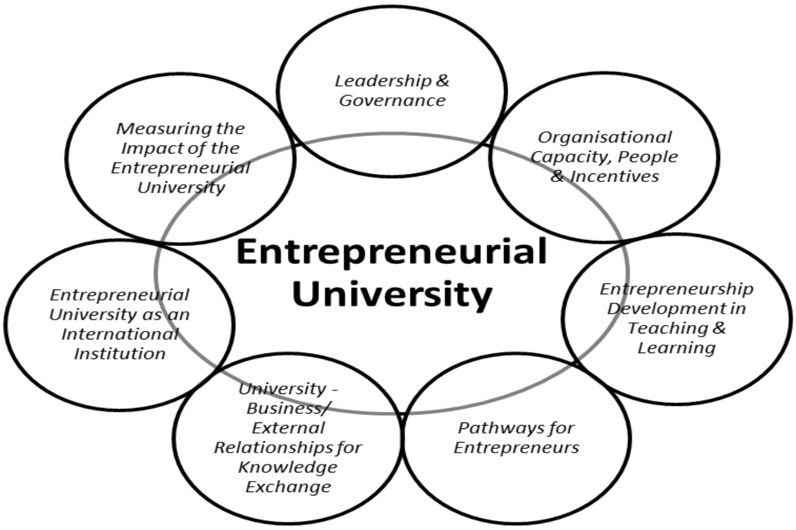

Figure 2.15: A Guiding Framework for Entrepreneurial Universities adopted from OECD (2012)

It is important to note at a practical level what impacts the development of and need for developing an Entrepreneurial University. Aspects such as the impact of disruptive technology (e.g. internet) creating open knowledge which is no longer just the domain of the universities (open innovation models will be discussed in more detail in Chapter 3); public-funded universities becoming less dependent on public funds; private sector competition growth; and improved future opportunities for employees/students/researchers (OECD, 2012).

The fact that the external environment has highly complex, unpredictable and changeable demands impacted by international trade, globalisation and competition, requires all organisations including universities to be more flexible and adaptive (Siegel, *et al*., 2003; Powers & McDougall, 2005; Visser, 2011; and OECD, 2012). However, some academics argue against policies and a shift towards an Entrepreneurial University as they believe that its entrepreneurship resides outside the universities' core capabilities (Florida, 1999). This resistance is further evident, as some academics argue that excessive shift toward commercialisation threatens the integrity and objective of the Teaching and Research Universities, and that policies should protect the interests of the academics (Conceição, *et al.*, 1998).

Other academics argue for it, as it will enhance the alignment between universities, industry and society (Kleinman & Vallas, 2001). Gulbransen & Smeby (2005) found that researchers that are closely involved with the industry also contribute significantly to traditional Research University outputs (for example publications). Di Gregorio & Shane (2003), and Visser (2011), both argue the role of implemented policies that incentivise commercialisation, such as patents, licensing, royalty sharing and equity share of spin-off or start-up businesses, that are adopted at numerous universities around the world. Furthermore, Visser (2011) found that the entrepreneurial culture and infrastructure together with sufficient investment policies are especially important in developing countries.

2.2.8. ENTREPRENEURIAL ECOSYSTEM AND GROWTH MODELS

In analysing potential growth models for innovation ecosystems, the triple helix model by Etzkowitz & Leydesdorff (2000) as illustrated in Figure 2.1, shows the functioning of the knowledge and commercial economy among the public, private and social sectors.

A more modern innovation theory is the quadro-helix growth model by Afonso *et al.* (2010) where the components are divided into government, academia, industry and civil society. While both are arguing the positive impact innovation brings to economic growth, they differentiate in structural components. Nonetheless, they provide conducive arguments for the importance of the innovation ecosystem.

However, with entrepreneurial universities becoming more and more significant to the knowledge and commercial economy, is an innovation ecosystem inclusive and more importantly supportive of entrepreneurial universities? As universities become more entrepreneurial, so will the need and purpose of its students, staff and local surrounding community. The key is then not to build an innovation ecosystem, but a conducive entrepreneurial and start-up ecosystem. This is evident in areas such as the Silicon Valley, Tel Aviv and Switzerland.

These *'start-up ecosystems'* have become an important role player to economic development and are especially promoted by private industry as cities such as the Silicon Valley being called the new Wall Street[7]. When considering what encapsulate a start-up ecosystem, it is clear that the innovation ecosystem has a strong correlation to a start-up ecosystem and forms a vital part of the start-up ecosystem (Tecnopolis Group, 2011; Marmer, et al., 2013; PrivewaterhouseCoopers, 2013). For example, Silicon Valley (ranking first) and Tel Aviv (ranking second) universities and research organisations are all surrounded by various commercialising organisations.

So what are the components of an entrepreneurial and start-up ecosystem? In analysing the work done by Monitor Company Group (2009), Herrington *et al.* (2011), Isenberg (2012)[8], Marmer *et al*. (2012), Vogel (2013) Cornell University, INSEAD & WIPO (2013), and CIPE (2014), a synthesis of the characteristics and components of the innovation/entrepreneurship/entrepreneurial/start-up ecosystem can be conceptually formulated.

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[7]Interesting online news articles by UT San Diego news portal inspiring the idea. [Online] Availabe at: http://www.utsandiego.com/news/2014/Mar/02/with-banking-experience-silicon-valley-is-the-new/ [Accessed on 12 March 2014].

[8] Isenberg, D., 2011. *Forbes: Introducing the Entrepreneurship Ecosystem: Four Defining Characteristics*. [Online] Available at http://www.forbes.com/sites/danisenberg/2011/05/25/introducing-the-entrepreneurship-ecosystem-four-defining-characteristics/ [Accessed 30 August 2014].

The GEM report by Herrington *et al.* (2011) argues the impact of the different components on the type drivers of the economy such as the factor-driven economies, efficiency-driven economies and the innovation-driven economies. The Start-up Genome report by Marmer *et al*. (2013) approaches the ecosystem based on eight key measurements to differentiate between different start-up ecosystems. Then the Monitor Company Group (2009) report approaches from a policy-making perspective, indicating which activities the policymakers can implement and which of them will have the highest impact on the ecosystem and economy.

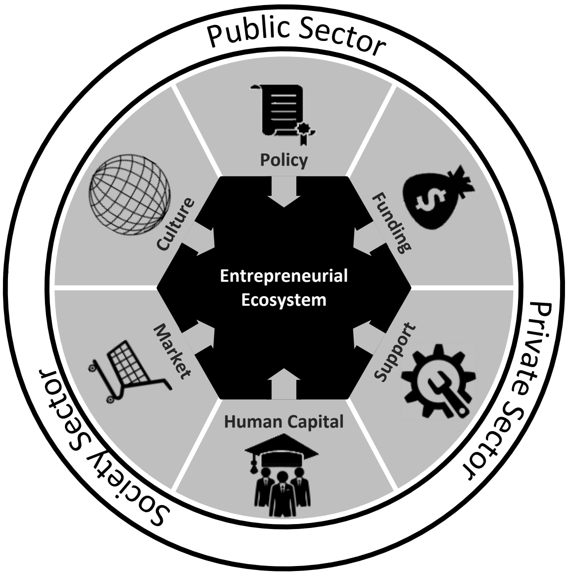

Figure 2.16: Conceptual Domains of the Entrepreneurial Ecosystem adapted from Isenberg (2012) and Vogel (2013)

Through combining the triple model with the various domains is essential to the entrepreneurial ecosystem which can be synthesised and formulated to be conceptually illustrated in Figure 2.16 above. These synergies can further be explained in components as listed in Table 2.4 below. Even though various components overlap, it is important to differentiate between entrepreneurial and non-entrepreneurial components (Vogel, 2013), while also taking into consideration which components are most effectively implemented from a external policy driving perspective to stimulate the entrepreneurial ecosystem (see Monitor Company Group, 2009).

Table 2.4: List of Entrepreneurial Ecosystem Components adapted from Isenberg (2012) and Vogel (2013)

Entrepreneurial Ecosystem Components	
Policies & Innovation	
Government: • Policy & Regulatory Framework (e.g. tax incentives, etc.) • Commercial-Friendly Lagislation & Property Rights (e.g. bankruptcy, contract enforcement, immigration & labour law, etc.) • Institutions & Research (e.g. investment, support, infrastructure etc.) • Financial Support (e.g. R&D) Infrastructure:	Leadership: • Unequivocal Support • Social Legitimacy & Freedom of People • Open Door Advocacy • Entrepreneurship & Regional Economic Development Strategy • Response to Crises & Challenges Innovation: • Knowledge & Skill Creation • Research & Development • Intellect Property Creation & Protection • Scientific Paper Publication Output

Entrepreneurial Ecosystem Components	
• Physical infrastructure (e.g. roads, energy, ICT, etc.) • Educational Institutions (e.g. universities)	• Development of New Process, Systems & Methods
Funding & Financial Capital	
• Award Competitions & Grants • Incubators & Accelerators • Angel Investors, FFFs • Venture Capital • Private Equity • Stock Exchange Markets	• Private Loans & Grants • Micro-Financing • Commercial Bank Debt • Smart Capital • Crowdfunding
Support Structures	
<u>Professional Support:</u> • Accounting & Legal Expertise • Mentors & Coaches • Investment Bankers & Physical Asset Managers • Technical Expertise & Advisers • Labour & Talents	<u>Non-Government Institutions:</u> • Non-Profits & Foundations Promoting Entrepreneurship • Information Hubs • Idea & Award Competitions • Conferences & Associations • Clusters, Tech Parks & Incubators
Human Capital & Higher Education	
<u>Education:</u> • General Degree, Diplomas, Certificates & Skilled Training (academic & professional) • Specific Entrepreneurship Qualifications & Training	<u>Labour:</u> • Skilled & Unskilled Labour Force • Serial Entrepreneurs • Mentors & Coaches • Later Generation Families
Markets & Locations	
<u>Geographical Location:</u> • Livability of the Vicinity • Cost of Living • Logistical Cost of Business <u>Networks:</u> • Entrepreneur's Informal Network (e.g. FFFs) • Diaspora & Group Networks (e.g. women entrepreneurship, etc.) • Formal Networks (e.g. multinational corporations, organisations & institutions).	<u>Customer Markets:</u> • Early (including beta users & early adopters) & Reference Customers • Customer Sophistication • Competitors & Market Saturation • Distribution Channels • Manufacturers & Suppliers • Large Corporations & Business to Business Market Sophistication
Culture & Motivations	
<u>Culture:</u> • Mindset, ambition, drive & creativity • Role models & Trendsetters • Self-Promotion Skills • Social Status of Entrepreneurs • Tolerance to Failure & Risk • Tolerance Towards Success	<u>Visibility:</u> • Events & Networking Meetups • Conferences • Idea/Start-up Competitions & Awards • Internet Portals & Forums • Media & Newspapers

2.3. SOUTH AFRICA'S INNOVATION ECOSYSTEM

2.3.1. SOUTH AFRICA'S INNOVATION INDEX

This subsection will discuss South Africa's innovation index as rated by the Global Innovation Index (2013, p. 244). The key indicators of South Africa is that it hosts a population of 51.1 million people and regenerates a

GDP of US$390.0 billion with a GDP per capita of US$11,302.2 PPP$. South Africa ranks 58th globally (overall score of 37.6/100) out of 142 countries that participated in the study while countries such as Switzerland (rank 1st, score 66.59), Sweden (rank 2nd, score 61.36), United Kingdom (rank 3rd, score 61.25), Netherlands (rank 4th, score 61.14) and United States of America (rank 5th, score 60.31) topped the global rankings as the most innovative countries.

The government set forth commitments to speed up growth and economic transformation in the 2011 to 2014 mid-term review by creating decent and sustainable working opportunities through the prioritising the following outputs:

- To **increase** the number of **job opportunities** by making growth more labour orientated;
- Strategies focused on the **decrease in youth unemployment** to be more clear, detailed, cost and multi-pronged orientated;
- **Improve the economy's competitiveness** by increased net exports through improved growth composition in world trade;
- **To improve and increase the support structures to small businesses and cooperatives.**

It is clearly evident that South Africa being a developing country is far off from the global leaders. The global leaders are all developed countries and classified as high-income countries while South Africa is classified as an upper-middle income country. South Africa's overall score can be further broken down into innovation input; innovation output and efficiency ratio (refer to Figure 2.5 above) which is summarised in Table 2.5 below from 2007 to 2013. Since 2007, South Africa has improved substantially in all departments and this was noticeable in the overall score while rankings have slightly decreased. When compared to similar countries, South Africa is ranked 16th of all upper-middle income countries (refer to Table 4 below) and 2nd of Sub-Saharan African countries. As South Africa is still a developing country, it is not expected to have a much higher achievement. The key is to improve continually on the country's strengths while drastically improving its weaknesses.

Table 2.5: South Africa's Innovation Index Summary from 2007 to 2013[9]

Year	Indicator	Score (0-100)	Rank	Income Type	Rank	Region Type	Rank
2013	***Index***	37.6	58th	UM	16th	SSF	2nd
	Input	43.93	51st	UM	9th	SSF	1st
	Output	31.26	71st	UM	25th	SSF	2nd
	Efficiency	0.71	99th	UM	-	SSF	20th
2012	***Index***	37.4	54th	UM	12th	SSF	2nd
	Input	46.4	45th	UM	5th	SSF	1st
	Output	28.5	73rd	UM	23rd	SSF	3rd
	Efficiency	0.61	116th	UM	-	SSF	22nd
2011	***Index***	35.22	59th	UM	13th	SSF	2nd
	Input	46.37	40th	UM	4th	SSF	1st
	Output	24.07	83rd	UM	19th	SSF	6th
	Efficiency	0.51	113th	UM	22nd	SSF	-
	Index	32.4	51st	-	-	-	-

[9] *Summarised from all the Global Innovation Index reports published from 2007 to 2013 (all 7 editions).* [Online] Available at: http://www.globalinnovationindex.org/ [Accessed 25 March 2014].

Year	Indicator	Score (0-100)	Rank	Income Type	Rank	Region Type	Rank
2010/ 2009	***Input***	43.4	35^{th}	-	-	-	-
	Output	21.5	99^{th}	-	-	-	-
	Efficiency	0.50	-	-	-	-	-
2009/ 2008	***Index***	34.1	43^{rd}	-	-	-	-
	Input	40.6	38^{th}	-	-	-	-
	Output	27.5	50^{th}	-	-	-	-
	Efficiency	0.68	-	-	-	-	-
2007	***Index***	28.7	38^{th}	-	-	-	-

When considering South Africa's strengths and weaknesses, the first evident strength is South Africa's overall innovation input and its first weakness being its innovation output and efficiency. South Africa is regarded as an inefficient innovator[10] and is on the borderline between underperformers and learning to become a possible next innovation leader in comparison between different countries GDP per capita (PP$) and GII scores. However, in the context of quality of innovation[11], South Africa's top three universities are ranked 7^{th} in the top ten middle-income countries, even though it has low patent filings, it makes up for it with numerous citable publications.

Table 2.6: A comparison summary of the top ten upper-middle income countries adopted from GII (2013, p. 19)

Rank	Innovation Index	Innovation Input	Innovation Output	Efficiency Ratio
1	**Malaysia (32)**	**Malaysia (32)**	China (25)	Costa Rica (9)
2	**Latvia (33)**	**Latvia (33)**	**Malaysia (30)**	Venezuela (10)
3	**China (35)**	Lithuania (35)	Costa Rica (31)	**China (14)**
4	Costa Rica (39)	**Montenegro (40)**	**Latvia (37)**	Argentina (20)
5	Lithuania (40)	**Chile (41)**	**Bulgaria (38)**	Ecuador (21)
6	**Bulgaria (41)**	**China (46)**	Romania (40)	Angola (22)
7	**Montenegro (44)**	Macedonia (48)	Argentina (43)	Dominican R. (28)
8	**Chile (46)**	**Bulgaria (50)**	Uruguay (46)	Turkey (29)
9	Romania (48)	***South Africa (51)***	**Chile (48)**	Romania (34)
10	Macedonia (51)	Russia (52)	**Montenegro (50)**	**Bulgaria (35)**

The strengths and areas of continual improvement of South Africa's innovation ecosystem[12] can be considered to be the following:

- ***Institutions:*** South Africa has a good regulatory (e.g. cost of redundancy dismissals, rule of law and regulatory quality) and business environment (e.g. ease of paying taxes, starting a business and resolving insolvencies). This is also substantiated as a strength by the World Bank (2014)[13] in their Doing Business in South Africa report.
- ***Human Capital & Research:*** The top three universities in South Africa are producing good quality research and innovation input.

[10] *Argument substantiated in Figure 4 on p. 24 of the GII (2013) report.*
[11] *Argument substantiated in Figure 3.1 on p. 26 of the GII (2013) report.*
[12] *Information derived from GII (2013) report on p. 244 and from the Global Innovation Index data analysis on South Africa's strengths and weaknesses.* [Online] Available at: http://globalinnovationindex.org/content.aspx?page=interactive-SW [Accessed 25 March 2014].
[13] *Argument substantiated in Figure 1.3-1.4 p. 8-9 of the World Bank (2014) report.*

- ***Infrastructure:*** The general infrastructure in South Africa is regarded as fairly sufficient and overall good, especially from a logistical performance perspective. However, a large geographically dispersed region increases cost of business.
- ***Market Sophistication:*** South Africa has a strong credit (ease of getting credit; domestic credit to private sector credit range; microfinance institutions gross loan portfolio can still improve a lot) and investment (investor protection, market capitalisation; large amount of trading on the JSE stock exchange; venture capital deals can still improve a lot as it is a young immature start-up ecosystem) policies, laws and application in the market.
- ***Business Sophistication:*** South Africa has good innovation linkages and knowledge absorption especially with university and industry research collaboration, and university royalty and license fees payments by university TTOs. Research & Development financing by government and businesses can still improve but is at a healthy state.

The weaknesses and areas of improvement of South Africa's innovation ecosystem can be considered to be the following:

- ***Institutions:*** South Africa's political environment in terms of government effectiveness and to avoid corruption is a serious weakness that requires improvement.
- ***Human Capital and Research:*** Education (expenditure on pupils and education; pupil-teacher ratio in secondary education), tertiary education (lack of data can be interpreted as areas for improvement) and research & development (increase the number of researchers, especially for applied research; measure impact and standard of all the universities in the country and not just the top three) has room for improvement as in recent years quality standards has dropped.
- ***Infrastructure:*** In recent years, there have been great improvements in the ICT sector, but issues such as ICT access and use, government's online services and e-participation can greatly improve. Ecological sustainability is another major weakness in South Africa in terms of expenditure on energy infrastructure and uses as well as environmental performance, but environmental ISO certification is good and efficient. Cost of business also increases with the large geographical dispersion of the country.
- ***Market Sophistication:*** Trade and competition are another improvement area in terms of the local competition intensity, non-agricultural market access and applied tariff rates such as taxes.
- ***Business Sophistication:*** A major problem in South Africa is the lack of skilled labour workforce (knowledge-intensive employment), South Africa has serious employment issues and problems with the education system which further complicate this issue. Other weaknesses are the foreign direct investment net inflow which is rather limited.
- ***Knowledge and Technology Outputs:*** South Africa is average ranked in knowledge creation, but can improve with more domestic patent registration and publications of scientific and technical articles (a strength is in the quality of numerous citable documents produced). The impact and diffusion of knowledge as new business creation and foreign direct investment net outflows are major weaknesses in need of improvement.

- ***Creative Outputs:*** Two areas of improvement would be Wikipedia monthly edits and YouTube video uploads, but this will automatically improve with more general access to ICT.

Another good comparison is to compare the African countries[14] whereby the best countries were Mauritius, South Africa, Uganda, Botswana, Ghana, Senegal, and Kenya. Mauritius and South Africa are clear leaders in the various innovation indicators and in some areas they even overtake *'high income'* countries, but there is still room for improvement.

2.3.2. UNIVERSITIES AND RESEARCH INSTITUTIONS

In South Africa, there are mainly two types of universities and research institutions which are Public and privately funded. Public funded universities and research institutions are categorised into traditional universities, comprehensive universities and universities of technology while there are also future planned universities. Privately funded universities and research institutions are categorised into design and art schools, theological seminaries and, universities and colleges.

The are also business schools which are categorised as either Public or privately funded universities or schools, but this depends on their independence and relationship to their affiliated universities, if any (e.g. University of Stellenbosch Business school is an independent privately owned company affiliated to the Public funded Stellenbosch University and would be classified as part of Stellenbosch University).

In South Africa, the Council of Higher Education (CHE) was one of the main regulatory bodies that accredited universities and colleges. Between 2004 and 2005, the higher education system was restructured with the merger of the South African Universities Vice-Chancellors Association (SAUVCA)[15] and the Committee of Technikon Principals (CTP)[16], and was renamed the Higher Education South Africa (HESA). This restructuring led to the merger of smaller universities (from 36 higher education institutions to only 23 universities) and the creation of three public universities categories. Other university alliances and collaboration initiatives worthy of mention are the the Cape Higher Education Consortium (CHEC), the Foundation of Tertiary Institutions of the Northern Metropolis (FOTIM) and the Southern Education and Research Alliance (SERA).

Then the South African Qualifications Authority (SAQA) is the regulating statutory body mandated by the National Qualifications Framework Act 67 of 2008 that oversees the development and implementation of the National Qualifications Framework (NQF). The NQF defines the guidelines, principles and boundaries of the qualifications system that is part of the education and training system of South Africa.

The privately funded universities and educational institutions bring another large dimension to the education and training system in South Africa with a large number of local campuses, foreign universities and distance-

[14] *Refer to Figure 4.1 on p. 30 of the GII (2013), please note that it was labelled "Sub-Saharan African" countries comparison, but included a broader list of countries including some West, East and North African countries.*
[15] *SAUVCA embodied twenty one public universities in South Africa by the University Act (No. 61 of 1955).*
[16] *CTP was comprised out of rectors, principals and Vice-Chancellors of technikons as a national higher education association which was established by the Advanced Technical Education Act (No. 40 of 1967).*

education universities. However, not all of these educational institutions offer accredited diplomas or degrees and are regulated by either private, independent or international accreditation statutory bodies. In order to register a private school, college or university in South Africa, HESA requires it to comply with SAQA[17] requirements and a comprehensive list of private higher education institutions in South Africa can be found in Appendix A1.

2.3.2.1. PUBLIC FUNDED UNIVERSITIES

All Public funded educational institutions in South Africa are overseen by three departments of the South African government, namely the Department of Basic Education (DBE), the Department of Higher Education and Training (DHET), and the Department of Science and Technology (DST). Originally the Department of Education, in 2009 it was divided into the DBE which oversees the education and training system for primary and secondary education at schools, and the DHET which oversees the education and training system for tertiary education at schools, colleges and universities respectively. The DST oversees scientific research done at the various public universities and is also responsible for the space programme.

According to the Department of Higher Education (2014), a total of 23 universities are Public funded (11 traditional, 6 comprehensive and 6 technology), while a further two more universities are in the process of being established (Univeristy of Mpumalanga and University of the Nothern Cape). The annual budget[18] spent on the public universities for 2013 was R26 billion and is mainly broken up into the following spending criteria:

- Block grants (operations costs of universities) accounted 70% of the budget;
- The National Student Financial Aid Scheme (NSFAS) accounted 14% of the budget;
- Building and other infrastructure accounted for 9% of the budget;
- Development funds (teaching, research and foundation provisions) accounted for 4% of the budget;
- While the remaining3% was for clinical training, veterinary sciences and other costs.

A summary of the public funded universities from 2007 to 2014 can be seen in Figure 2.17 below. The budget for 2014 has increased to ZAR 28 billion while the percentage spending will remain approximately the same for the different spending criteria. This is a clear increase in funding for education from 2004 which only amounted to just under ZAR 10 billion. The budgetary allocation per university is calculated by means of a formula defined by the Council of Higher Education in a report by Steyn and De Villiers (2005). Notably, there has also been a substantial increase in 'other' category in recent years which is financing going towards the development of the planned two new universities.

The public universities that receive the most funding are the University of South Africa, the Tshwane University of Technology, the University of Pretoria and the University of KwaZulu-Natal. On average over the past 8 years,

[17] *SAQA: Higher Education Institutions.* [Online] Available at http://www.saqa.org.za/show.php?id=5457 [Acessed 20 March 2014].

[18] Department of Higher Education, 2014. *Public Report: University State Budgets*. Pretoria: DHET. Website: http://www.dhet.gov.za/Documents/Reports/ [Accessed 27 March 2014].

just under ZAR 500 million funding was available per university in South Africa. The key differences in funding amounts are evidently measured by the performance with regards to teaching and publication output. The universities that have a strong balance between education and research output receive the highest funding which is illustrated below in Figure 2.18 and Figure 2.20.

The total research publications output per public funded university in South Africa is summarised in Figure 2.18 below. The public universities that produced on average (period 2007 to 2012) the most research output are the University of Pretoria, the University of Stellenbosch, the University of Cape Town and the University of Kwazulu-Natal. The average number of research publications produced per university in South Africa is just under 700 publications.

The total teaching output per public funded university in South Africa is summarised in Figure 2.20 below while Figure 2.19 summarises the average teaching qualification output. The statistics show that we are educating an average of just under 140 000 students per year through our Public funded universities. These students per year can further be subdivided into the different types of qualifications, mainly undergraduate and postgraduate studies. It is evident that an average of 77% of the total teaching output produced per year is undergraduate studies with only 26% of the undergraduate students being professional (4-year) degrees. Of the remaining 23% postgraduate students produced per year, 56.5% of the postgraduate students are Honours Degrees or Higher Diplomas.

It is also important to note that research Masters and Doctorate postgraduate degrees are not considered as teaching output and primarily form part of the research publications output. This is further debatable as there are cases where Honours Degree students and undergraduate students have also produced publications, but these are special cases and can be ignored as having any real effect on the statistical data. The next subsections will consider the statistics and information regarding the three different types of universities in South Africa.

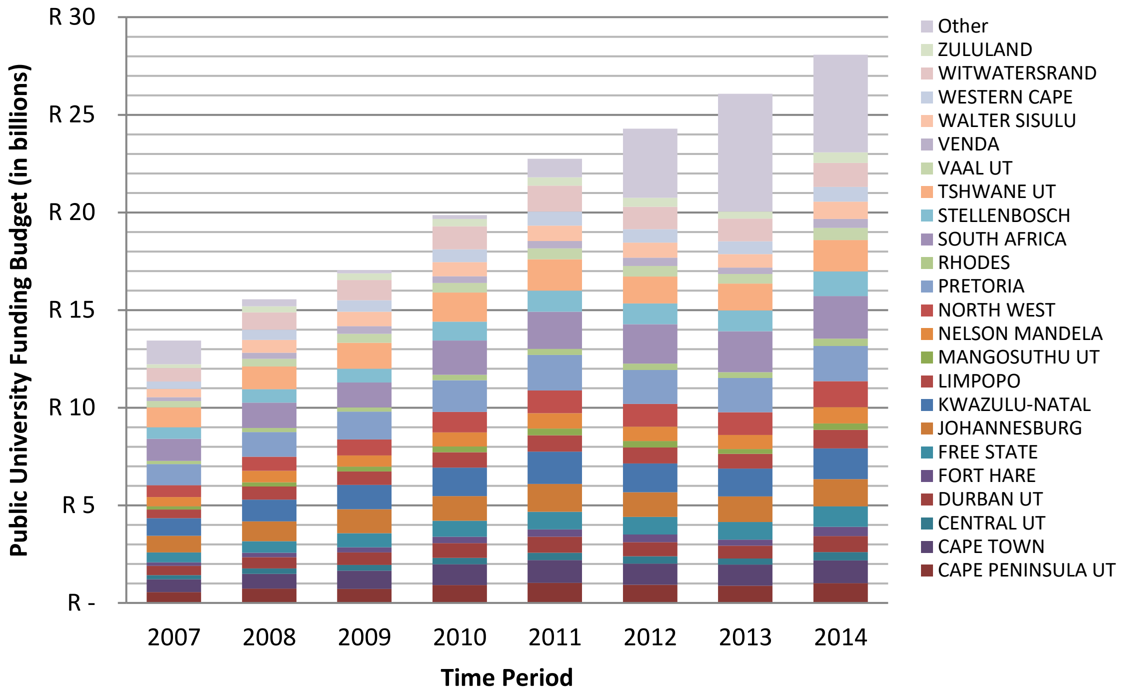

Figure 2.17: Public University Funding Budget from 2007 to 2014[19] (DHET, 2014)

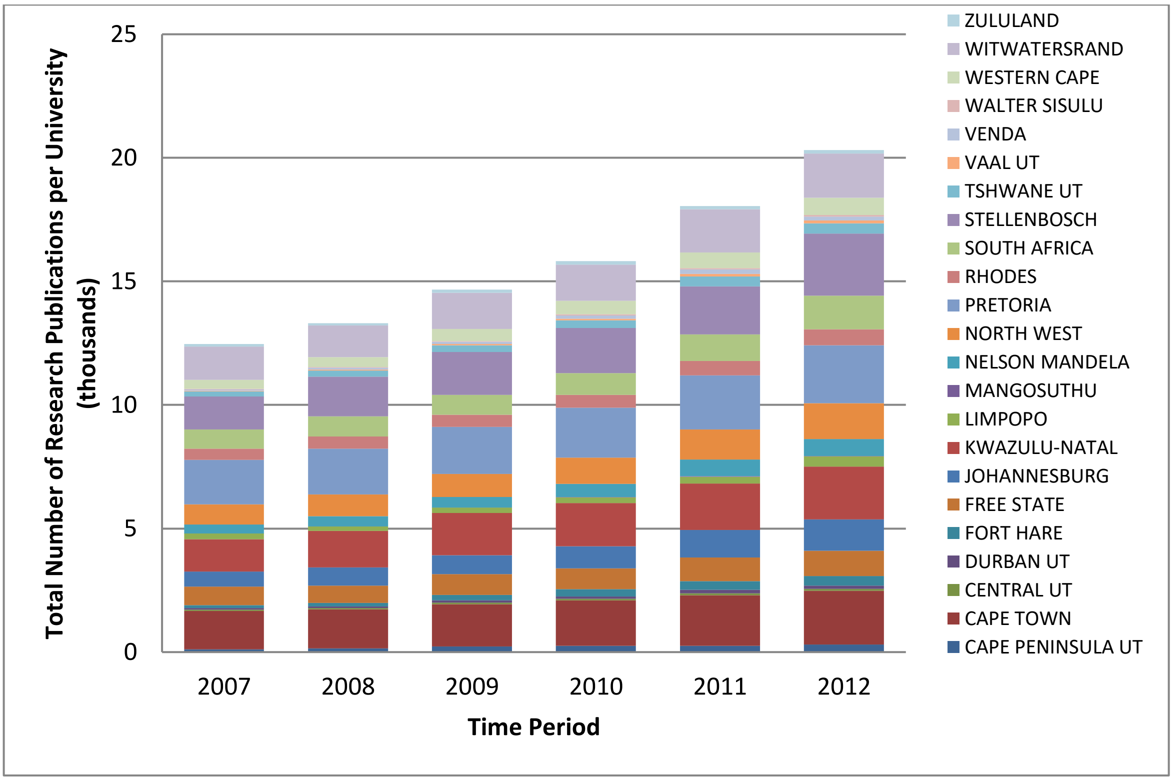

Figure 2.18: Total Research Publications Output per Public University in South Africa (DHET, 2014)

[19] Data adopted and adapted from the Department of Higher Education and Training (DHET), 2014. *Public Report: University State Budgets*. Pretoria: DHET. Website: http://www.dhet.gov.za/Documents/Reports/ [Accessed 27 March 2014].

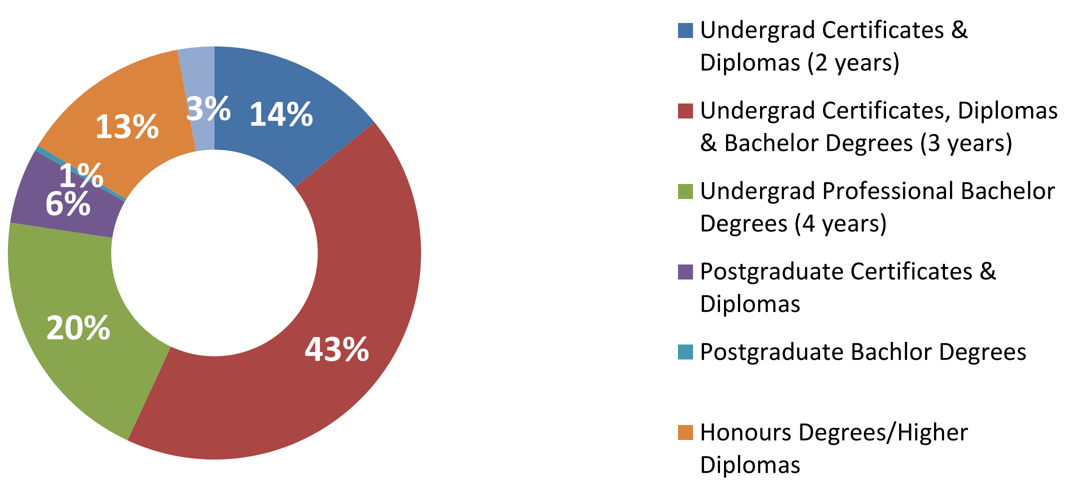

Figure 2.19: Average Teaching Output Per Qualification Area for Higher Education Institutes in South Africa (DHET, 2014)

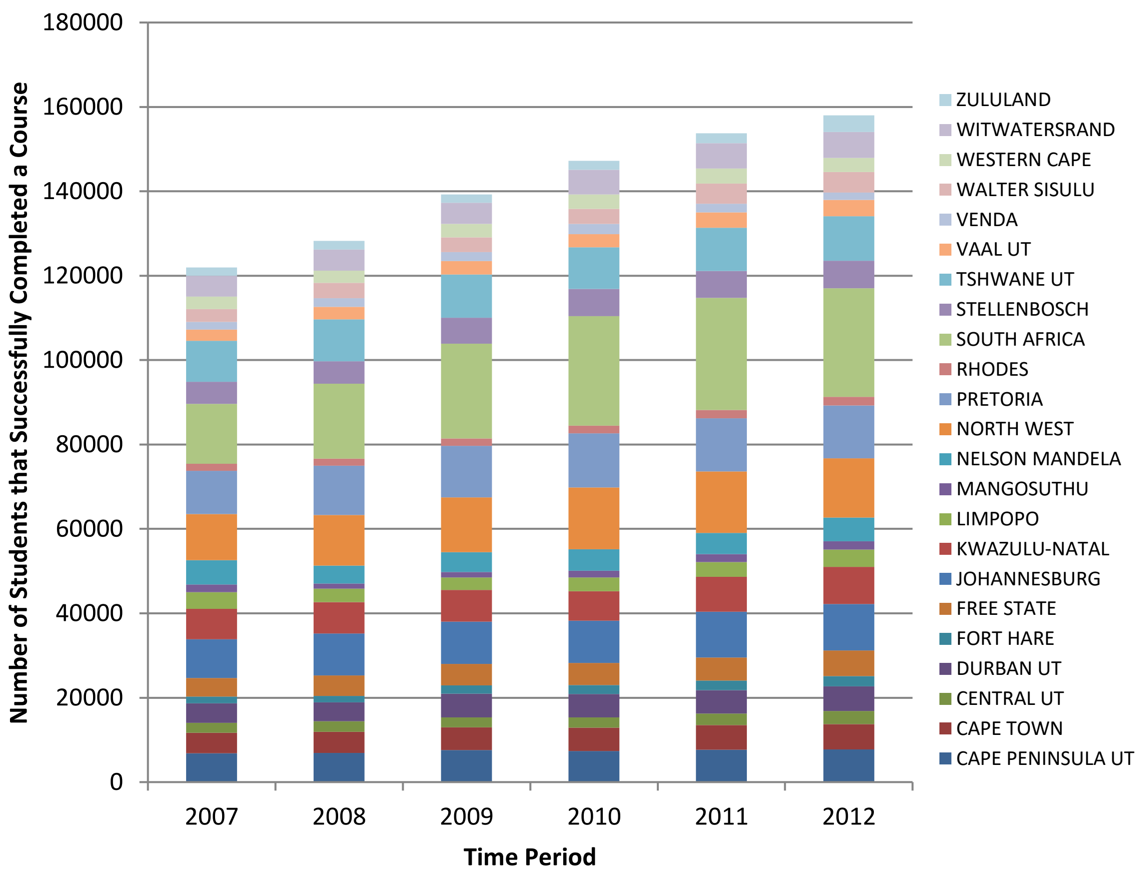

Figure 2.20: Teaching Output of the Public Funded Higher Education Institutions in South Africa (DHET, 2014)

2.3.2.1.1. TRADITIONAL UNIVERSITIES

Traditional universities are universities that offer degrees that are more theoretically orientated and usually mainly focused on basic research. In Table 2.7 below shows a list of the various traditional universities that are funded by the South African government. Traditional universities still receive the majority of the public funding which from 2007 to 2012 averaged at a total of ZAR 9 billion per year. The four biggest traditional universities receiving such funding are the University of Pretoria, the University of KwaZulu-Natal, the University of the Witwatersrand, and the North-West University. The teaching output performing universities are North-West University, the University of Pretoria and the University of KwaZulu-Natal, while the research output performing universities are the University of Pretoria, the University of Stellenbosch and the University of Cape Town.

Table 2.7: List of traditional universities funded by the government of South Africa

Institution	Location(s)	Website	Est.	Status
University of Cape Town	Cape Town	www.uct.ac.za	1829	1918
University of Fort Hare	Alice, Bhisho, East London	www.ufh.ac.za	1916	-
University of the Free State	Bloemfontein, QwaQwa	www.uvos.ac.za	1904	1950
University of KwaZulu-Natal	Durban, Pietermaritzburg, Pinetown, Westville	www.ukzn.ac.za	2004	2004
University of Limpopo	Ga-Rankuwa, Polokwane	www.ul.ac.za	2005	2005
North-West University	Mafikeng, Mankwe, Potchefstroom, Vanderbijlpark	www.nwu.ac.za	2004	2004
University of Pretoria	Johannesburg, Pretoria	web.up.ac.za	1908	1930
Rhodes University	Grahamstown	www.ru.ac.za	1904	1951
University of Stellenbosch	Bellville, Stellenbosch, Saldanha Bay, Tygerberg	www.sun.ac.za	1866	1918
University of the Western Cape	Bellville, Cape Town	www.uwc.ac.za	1959	1970
University of the Witwatersrand	Johannesburg	www.wits.ac.za	1896	1922

2.3.2.1.2. UNIVERSITIES OF TECHNOLOGY

Universities of Technology were known as 'Technikons' in the past and offer diplomas and degrees that are more vocationally orientated and focuses more on applied research. In Table 2.8 below, is a list of the various universities of technology that are funded by the South African government. Universities of technology receive the minority of the public funding which from 2007 to 2012 averaged at a total of just under ZAR 4 billion per year. The three biggest receiving universities of technology are the Tshwane University of Technology, the Cape Peninsula University of Technology, and the Durban University of Technology. The three top performing teaching output universities of technology are the same as three as the biggest funding receivers. Their performance on education output is also on par with traditional universities, but their research output ability is well below the average.

Table 2.8: List of Universities of Technology funded by the government of South Africa

Institution	Location(s)	Website	Est.	Status
Cape Peninsula University of Technology	Bellville	www.cput.ac.za	2005	2005
Central University of Technology	Bloemfontein, Welkom	www.cut.ac.za	1981	-
Durban University of Technology	Durban, Pietermaritzburg	www.dut.ac.za	2002	2007
Mangosuthu University of Technology	Umlazi	www.mut.ac.za	1979	-
Tshwane University of Technology	Ga-Rankuwa, Nelspruit, Pretoria, Polokwane, Soshanguve, Witbank	www.tut.ac.za	2003	2003
Vaal University of Technology	Kempton Park, Klerksdorp, Upington, Secunda, Vanderbijlpark	www.vut.ac.za	1966	2003

2.3.2.1.3. COMPREHENSIVE UNIVERSITIES

Comprehensive universities are a combination between the traditional universities and universities of technology, by offering a combination of the two types of qualification. In Table 2.9 below, a list of the various comprehensive universities that are funded by the South African government. Comprehensive universities also receive a minority of the public funding which from 2007 to 2012 averaged at a total of ZAR 5 billion per year. The three biggest receiving traditional universities are the University of South Africa, the University of Johannesburg, and the University of Walter Sisulu. The teaching output performing universities are the University of South Africa, and the University of Johannesburg, while the same universities' research outputs are above average, but only slightly. It is clear that comprehensive universities are more geared towards education output than research output. However, only the University of South Africa, and the University of Johannesburg are performing above average while the rest are performing below average.

Table 2.9: List of comprehensive universities funded by the government of South Africa

Institution	Location(s)	Website	Est.	Status
University of Johannesburg	Johannesburg, Soweto	www.uj.ac.za	1967	2005
Nelson Mandela Metropolitan University	George, Port Elizabeth	www.nmmu.ac.za	1964	2005
University of South Africa	Nationwide, Pretoria HQ	www.unisa.ac.za	1873	-
University of Venda	Thohoyandou	www.univen.ac.za	1982	-
Walter Sisulu University	Butterworth, East London, Mthatha, Queenstown	www.wsu.ac.za	1977	-
University of Zululand	Empangeni	www.unizulu.ac.za	1960	-

2.3.2.1.4. SUMMARY OF PUBLIC FUNDED UNIVERSITIES IN SOUTH AFRICA

The three university types in South Africa are clearly different in dates established as well as performance output. The top performing universities in both education and research seem to be favouring traditional universities while research output performers are mainly traditional universities. It is evident on world university ranking reports[20] that the following five universities are consistently highly ranked in Africa:

(1) University of Cape Town;
(2) University of Witswatersrand;
(3) University of Stellenbosch;
(4) University of Pretoria;
(5) University of KwaZulu-Natal.

Even though the ranking indicators are debatable, it brings another view to Public funded universities in South Africa. The most clearly evident fact is that Public funded universities are improving, and more funding is made available for education in South Africa. South African universities are mainly focused around education, rather than basic research. This further aligns with the results from the Global Innovation Index (2013) for the Human Capital Research, and Knowledge and Technology Output respective indicators as mentioned earlier.

2.3.2.2. PUBLIC COLLEGES

In addition to public universities, South Africans can receive education from fifty registered and accredited public Further Education and Training (FET)[21] colleges which were established by the DHET and operate under the Further Education and Training Colleges Act 16 of 2006. According to FET Colleges (2014), the DHET subsidises the public FET colleges with approximately ZAR 4 billion each year while there are considered to be approximately 300 000 students being educated in public FET colleges in South Africa. These are all education-based output and have limited to non-existent research-based output. The quality of public FET colleges is also regulated by a Quality Assurer and must be certified according to the SABS ISO 9001: 2008 certification.

2.3.2.3. PRIVATE COLLEGES AND UNIVERSITIES

There is no formal list available giving the exact details of the various private schools, colleges and universities in South Africa, but through a basic online search the more well-known private education centres were found. In Appendix A1, the various private education colleges and universities that are accredited as diploma or degree-granting institutions[22] are listed. These institutions serve mainly as education centres with limited, if any, postgraduate research purposes.

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[20] The ranking of South African universities are well summarised in the following online article:
Wikipedia, 2014. *Ranking of Universities in South Africa.* [Online] Available at http://en.wikipedia.org/wiki/Rankings_of_universities_in_South_Africa [Accessed 20 April 2014].

[21] A list of government funded FET colleges can be viewed on Career Advice Services, 2012. *List of Government FET Colleges*. [Online] Available at http://mobi.careerhelp.org.za/page/mobile/colleges_universities/429659-List-of-Government-FET-Colleges [Accessed 20 April 2014], and FET Colleges, 2014. *Public FET Colleges*. [Online] Available at http://www.fetcolleges.co.za/Site_Public_FET.aspx [Accessed 20 April 2014].

[22] A list of private FET colleges can be can be viewed on Career Advice Services, 2012. *List of Private FET Colleges*. [Online] Available at http://mobi.careerhelp.org.za/page/mobile/colleges_universities/430112-List-of-private-FET-Colleges [Accessed 20 April 2014], and Wikipedia, 2014. *List of Post-Secondary Institutions in South Africa*.

In total there were 38 different private education institutes which were categorised into three main types, namely theological seminaries (12), colleges (19) and universities (7) as illustrated in Figure 2.21 below. The theological seminaries in South Africa either act as college or universities specialising solely in theology. The other private colleges and universities all specialise in various fields ranging from filming to applied sciences, while some have multiple campuses across South Africa.

For the purpose of this research paper, these private educational institutions are considered not to directly create intellectual property and are only included to help define the scope of the innovation landscape in South Africa.

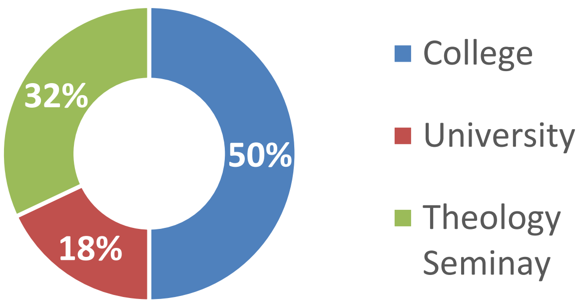

Figure 2.21: Percentage of different private educational institutes in South Africa that are registered at the DHET

2.3.2.4. BUSINESS SCHOOLS

In countries such as United States of America and Israel, highly ranked business schools have a major impact on the start-up ecosystem especially, for example, Stanford University in the Silicon Valley and the Tel Aviv University's Leon Recanati Graduate School of Business. The main reason for the positive impact is the generation of human and knowledge capital in the form of business acumen to produce wealth through international trade and industrial partners.

Table A.2 in Appendix A2, lists the registered business schools in South Africa. In South Africa, there is a total of 23 registered business schools which are accredited by the South African Council of Higher Education (CHE). Other accredited business schools persue international accreditation from AMBA, EQUIS and AACSB. Business schools' purposes are defined as accredited, degree-granting, postgraduate educational institutions.

Business schools are most well known for their Master in Business Administration (MBA) degree which was first offered in North America[23]. The first business school in South Africa was founded in 1949 by the University of

[Online] Available at http://en.wikipedia.org/wiki/List_of_post_secondary_institutions_in_South_Africa [Accessed 20 April 2014].

[23] Quacquarelli Symonds Limited, 2012. *History of the MBA*. [Online] Available at http://www.topmba.com/why-mba/history-mba-mba-friday-facts [Accessed 20 June 2014].

Pretoria Graduate School of Management[24] which was the first MBA degree outside North America, but, unfortunately, is now defunct. Today, the oldest business school still in operation is the University of Cape Town Graduate School of Business and University of Stellenbosch Business School both founded in 1964, while the newest business school is the Nelson Mandela Metropolitan University Business School, founded in 2005.

From the 23 business schools in South Africa, the majority are registered and accredited by CHE while only 6 business schools are accredited by international MBA accreditors. The top-ranked business schools in South Africa[25] are the University of Cape Town Graduate School of Business, Gordon Institute of Business Science, University of Stellenbosch Business School and WITS Business School.

2.3.2.5. OTHER RESEARCH INSTITUTIONS AND COUNCILS

All research institutions and councils that are Public funded by the government are defined by the IPR Act 51 of 2008, which defines the institutions as a statutory institution listed in the IPR Act 51 of 2008 under Schedule 1. These institutions are listed in Appendix A3 with the majority of these institutions having additional regulatory acts specifically governing their mandate. The majority of these research institutions and councils provide internal TTOs which govern technology licencing and intellectual property management.

Privately funded research institutions are not specifically registered or listed on any governmental organisation and will not be considered for the purpose of this research paper. These would generally include R&D by various larger organisations or corporations.

2.3.3. TECHNOLOGY TRANSFER OFFICES

In the space of innovation and commercialisation, intellectual property is of vital importance in commercialising knowledge capital. According to the World Intellectual Property Organisation (WIPO)[26], "intellectual property (IP) refers to creations of the mind, such as inventions; literary and artistic works; designs; and symbols, names and images used in commerce".

Intellectual property rights form part of a global marketplace and are protected by legislation both internationally and nationally (SABS Design Institute, 2008). In South Africa, there are various legislation acts

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[24] Surreal Limited, 2012. *The MBA in South Africa*. [Online] Available at http://www.mba.co.za/infocentre.aspx?s=48&c=4#title [Accessed 20 June 2014].

[25] The ranking of South African business schools can be found at Eduniversal Ranking, 2013. *Business Schools Ranking in South Africa*. [Online] Available at http://www.eduniversal-ranking.com/business-school-university-ranking-in-south-africa.html [Accessed 20 June 2014]; University World News, 2013. Global Ranking Highlight African Business Schools. [Online] Available at http://www.universityworldnews.com/article.php?story=2013070607385921 [Accessed 20 June 2014]; and Wikipedia, 2013. *Ranking of Business Schools in South Africa*. [Online] Available at http://en.wikipedia.org/wiki/Rankings_of_business_schools_in_South_Africa [Accessed 20 June 2014].

[26] Formal definition for the online WIPO. [Online] Available at: http://www.wipo.int/about-ip/en/ [Accessed on 20 March 2014] and is similar to the definition by Patents.org. [Online] Available at: http://www.patent.gov.uk/design/glossary/ [Accessed on 20 March 2014]

and policies regulating the daily activities of commercial businesses. In the space of intellectual property, the main legislation that is applicable is as follows:

- Competition Act 89 of 1998,
- Copyright Act 98 of 1978,
- Copyright Regulation Act of 1985,
- Design Act 195 of 1993,
- Design Regulations Act 4 of 2006,
- Higher Education Act 101 of 1997,
- Patents Act 57 of 1978,
- Plant Breeders' Rights Act 15 of 1976,
- Technology Innovation Agency Act 26 of 2008,
- Trade Marks Act 194 of 1993,
- Trade Marks Regulations Act of 2006.
- Intellectual Property Rights from Public Financed Research and Development Act 51 of 2008 (IPR-PFRD Act), and
- National Environmental Management Biodiversity Act 10 of 2004,

This legislation is enforced by government-established organisations such as the National Intellectual Property Management Office (NIPMO), Companies and Intellectual Property Commission (CIPC), and the Department of Trade and Industry. The agencies, legislation and policies are collectively seen as a 'national innovation system' (NIS).

The main legislation that university TTOs are regulated by are the Intellectual Property Rights from Publicly Financed Research and Development Act (IPR-PFRD Act 51 of 2008) and the Higher Education Act 101 of 1997. With the IPR-PFRD Act and the other new legislation, the Technology Innovation Agency Act 26 of 2008 was introduced in South Africa. This then led to the establishment of the Technology Innovation Agency (TIA) with the purpose of stimulating and enabling technology inventions and innovation to promote economic growth.

The formulation the legislation framework regarding intellectual property led to the establishment of the National Intellectual Property Management Office (NIPMO). NIPMO's functions are to manage the the newly established Intellectual Property Fund (IPF), establish new TTOs at higher education institutions (e.g. universities) and science councils, and provide financial and industry network connection support. The main objective of the IPR-PFRD Act is to, together with the other Acts and the supporting governmental organisations, make provision for the development of intellectual property from Public funded organisations and to ensure that it is utilised and commercialised for the benefits of society from economic growth. This provides public funded universities in South African with new challenges and opportunities.

2.3.3.1. SOUTH AFRICAN PUBLIC FUNDED UNIVERSITY TTOs

In South Africa, TTOs are fairly new as the first efforts promoting technology transfer were only in the early 1980s while the first TTOs were only established in the mid-1990s (Wolson, 2007; Alessandrini, et al., 2013). NIPMO on the other hand, assists, finances and supports every one of the 23 public funded universities in South

Africa[27]. However, not every university has a fully functioning TTO, while most merely have a representative in charge of research management of the university.

According to SARIMA[28] and Alessandrini *et al*. (2013) there are presently thirteen active and registered TTOs associated to the public funded universities in South Africa, which are listed in Table 2.10 below. These TTOs seem to be function as either dedicated offices and at times almost like a department of the organisations, while other TTOs have complete or partially owned associated companies in charge of the organisation's technology transfer activities (Wolson, 2007). She also states that organisations without TTOs do not actively participate in technology transfer and at times use third-party contract service providers on a case-by-case basis if required by the individual researcher or organisation's departments.

Table 2.10: List of Technology Transfer Offices for Public Universities in South Africa

Institution	Associated University	Website	Est.	Formal	Type
Research Contracts and Intellectual Property Services	University of Cape Town	www.rcips.uct.ac.za	1999	Yes	TTO
Innovus	University of Stellenbosch	www.innovus.co.za	1999	Yes	TTO
Technology Transfer and Innovation Support	North-West University	www.nwu.ac.za/i-ttis	2001	Yes	TTO
Research Office	University of KwaZulu-Natal	www.research.ukzn.ac.za/IntellectualPropertyTechnologyTransfer.ac.za	2008	Yes	RO
Technology Transfer Office	Nelson Mandela Metropolitan University (NMMU)	www.techtransfer.nmmu.ac.za	2007	Yes	TTO
Eastern Cape Regional Technology Transfer	University of Fort Hare, Walter Sisulu University, Rhodes University & NMMU.	www.techtransfer.nmmu.ac.za/Regional-Technology-Transfer	NA	Yes	TTO
WITS Enterprise	University of the Witswatersrand	www.wits-enterprise.co.za	2006	Yes	TTO
Commercialisation & Technology Transfer Office	University of Johannesburg	www.uj.ac.za/EN/CorporateServices/Commercialisation	2005	Yes	TTO
Technology Transfer Office	University of Pretoria	web.up.ac.za/default.asp?ipkCategoryID=12840	NA	Yes	TTO
Technology Transfer Office	University of the Western Cape	www.uwc.ac.za/SO/BIC/TTO/Pages/default.aspx	NA	Yes	TTO
Innovation Management Support	Tshwane University of Technology	www.tut.ac.za/Other/rninew/Innovation/Pages/default.aspx	NA	Yes	TTO
Technology Transfer Office	Cape Peninsula University of Technology	www.cput.ac.za/research/tto	NA	Yes	TTO

[27] National Intellectual Property Management Office (NIPMO), 2013. *List of Associated Universities*. [Online] Available at http://www.nipmo.org.za/links/46 [Accessed on 20 August 2014].

[28] South African Research & Innovation Management Association (SARIMA), 2013. Innovation and Technology Transfer. [Online] Avalabile at http://www.sarima.co.za/innovation-technology-transfer/innovation-resources/ [Accesses 21 June 2014], and Alessandrini, Klose & Pepper (2013).

Institution	Associated University	Website	Est.	Formal	Type
Directorate Research Development	Free State University	supportservices.ufs.ac.za/ content.aspx?DCode=459	2009	Yes	TTO

As the technology transfer activity and industry partnerships with universities grow in South Africa, more and more TTOs are being set up. With the new IPR-PFRD Act, the roles and functions are also promoting understanding and best practices of technology transfer in South Africa. However, according to a national research survey by Alessandrini, *et al*. (2013, p. 7-8), the South African Higher Education Institutions and Science Councils had a wide perspective of technology transfer and its definition, application and implementation with regard to their intellectual property, some arguing for commercialisation and others to some extent against it. However, as mentioned above (p. 19), the roles and functions of TTOs as defined by WIPO (2005), clearly illustrate far more responsibilities of TTOs than what is regarded as required in South Africa.

Generally TTOs main goal is to transfer research into the private sector. As mentioned above, TTOs have three main ways to diffuse technology into the market which is to sell university research, licence out the university research or to create a spin-off company (Visser, 2011, and Laperche, 2002). Of these three revenue streams, selling and licencing the intellectual property to industry partners is less time-consuming and considered from a risk-reward perspective is 'less risky'. However, with South Africa being an emerging economy without an extensive industry partners network, although it is still growing, and an absurdly high unemployment rate[29] (especially among the youth), a case can be made for TTOs to specifically focus, promote and specialise in establishing spin-off companies.

The fact that entrepreneurship and the impact of entrepreneurial start-up businesses can have a significant impact on the economy in creating employment, poverty alleviation and GDP contribution is a strong reason for TTO policies to strive towards creating more spin-off companies.

2.3.3.2. BENCHMARKING TTO PERFORMANCES

In the present literature, no comprehensive data can be found to benchmark the performances of the TTOs in South Africa. However, some rough data from Wolson (2007), Heher (2007) and Alessandri *et al*. (2013) does provide some insights into the performances of TTOs. In the performance data from Wolson (2007), four South African universities with registered TTOs were analysed from 2001 to 2003 and are represented in Table 2.11 below. One can only speculate which universities are represented, but nonetheless benchmark averages can be obtained from the data.

Table 2.11: Summary of Four South African Universities TTO Performance Data adapted from Wolson (2007)

Indicators	Year	University A	University B	University C	University D	Note

[29] South Africa's unemployment rate has been above 25% for the past 14 years according to Trading Economics, 2014. *South African Unemployment Rate: 2000-2014*. [Online] Available at http://www.tradingeconomics.com/south-africa/unemployment-rate [Accessed on 22 August 2014].

Staff	2003	1,246	1,924	1,014	530	
Students	2003	19,978	24,769	16,660	27,729	
Licences	2001	2	0	3	3	*4.0 licences per US$100 million ATRE*
	2002	4	0	3	1	
	2003	3	0	3	1	
Licenses Income	2001-2003	R209,000	-	R1,656,948	R32,173	*0.1% of research income*
Spin-off Companies	2001	1	0	4	3	*3.1 spin-off companies per US100 million ATRE*
	2002	0	2	2	4	
	2003	1	0	1	0	
Patent Budget	2002-2004	R450,000	R355,000	R500,000	R800,000	*0.3% of research income*
TTO Staff:						
Professional		1	4	3	4	
Support		1	1.5	2	1	

When the above data is combined with some of the data from Heher (2007), the following performance benchmark can be concluded as summarised in Table 2.12 below. As discussed in more detail above (refer to p. 20), Heher (2007) developed an international benchmark for the performances of TTOs. It is clear that even at that time with five active university TTOs, there was still a long way to go as a developing country in producing innovation output.

Table 2.12: South African TTO Performance Comparison to International Benchmarks Heher (2007)

Category	International Benchmark for Developing Countries	South African (For 5 Universities in 2004)	Projections[30]
Research Expenditure (ATRE)	Per US$100 million	Per US$100 million	*US$500 million*
Invention Disclosures	40-60	23	*200–300*
Patents	20-30	6	*100–150*
Licences	10-15	4	*60–100*
Spin-off Companies	1-5	3	*5–20*
Income	0.2–0.5%	0.3%	
Patent Budget	1–2% of total	0.1% of total	*US$5–10 million*
Size of Staff	4–20	9	*20–100*

In a more recent study by Alessandri *et al*. (2013), it is clear that the number of universities in South Africa with registered and active TTOs has more than doubled. This trend in increased technology transfer activity is illustrated in Figure 2.22 below which consists of a number of invention disclosures, provisional fillings, SA patents granted, international patents granted, licenses to industry and trademarks. The insufficient data and information inhibits a sufficient performance benchmark analysis and requires an improved data collection set.

[30] *Projections are based on the international norms.*

In other information that was available, Nel (2013), the CEO of Innovus which is the technology transfer office associated to Stellenbosch University, when reporting on the previous year's technology transfer activities reported on an impressive year of 16 licences, 14 provisional patents, 23 disclosures received and 2 spin-off companies from the University's intellectual property. According to Nel (2013), this is the best TTO performance compared to any other University in Africa. With insufficient information to substantiate on this, it is nonetheless information that indicates the continued growth in performance in technology transfer activities across South Africa.

Other important aspects that were highlighted by Heher (2007) with regards to technology transfer for developing countries are summarised as follows:

- There is a lack of actual technology transfer performance data for developing countries across the world to draw up standardised performance benchmarks;
- On performance projections (based on international norms), South Africa's entire research and innovation output can expect 200–300 invention disclosures which will 7–10 years downline produce a portfolio of 500 active licences, roughly generating a total of US$5–10 million per year. The majority of the universities will make a loss while a few will probably be profitable.
- The fundamental assumption of this research is based on the assumption that the data from developed countries with well-established support, funding and innovation output, is scalable down to developing countries. Updated and detailed data sets are required to ensure appropriate benchmarking standards and to construct more accurate economic impact models.
- Another challenge for South Africa is prolonged support and funding similar to that in the developed countries.

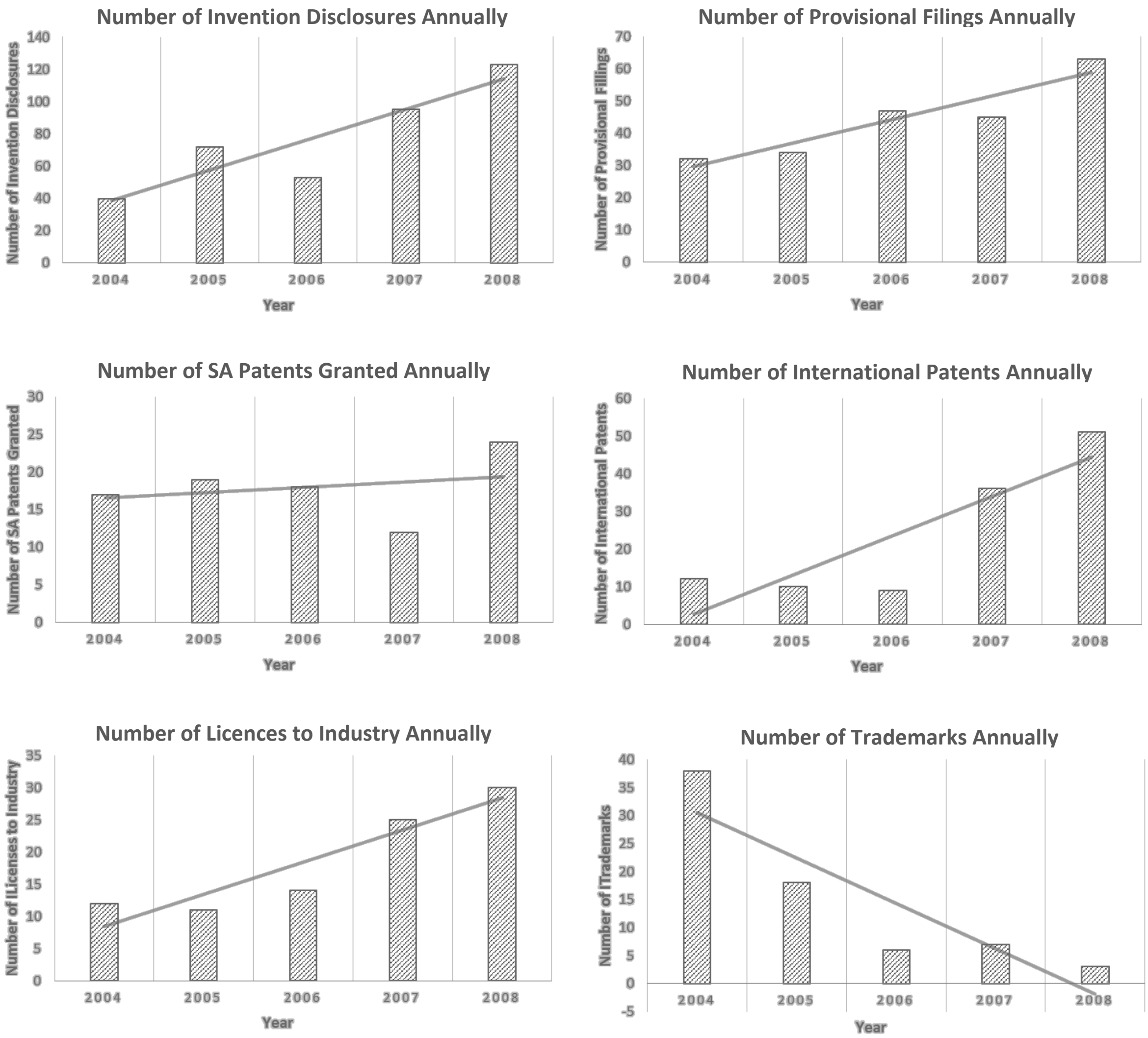

Figure 2.22: South African Higher Education Institutions Intellectual Property Outputs[31] adapted from Alessandrini *et al*. (2013)

2.3.3.3. TTO COMMERCIALISATION CONSIDERATIONS

As in most cases between developing and developed countries, benchmarks can readily be drawn from the developed country and used as guidelines for developing countries. In this case, international benchmarks are useful to compare competitiveness. Numerous lessons can be learned from developed countries, but most essential for South Africa to succeed is to set in place the platform governed by appropriate international standards from which to grow from. In this section, success and inhibiting factors as well as other challenges to technology transfer and commercialisation are identified in the literature. These will be in addition to the

[31] *A new national research survey on TTO performances for the past 20 years is currently underway and is expected to be complete towards the end of 2015. This research survey is aimed at collecting all the data regarding technology transfer at each university and science council in South Africa. It is also jointly run by SARIMA and the Human Resource Council while overseen by NIPMO.*

numerous challenges identified above (refer to p. 14) and which specifically focus on aspects related to South Africa.

2.3.3.3.1. COMMERCIALISING SUCCESS FACTORS

According to Alessandri *et al*. (2013) the following success factors were identified by TTOs in their national research survey:

- The South African government supplying policies and establish a working environment that fosters and promotes entrepreneurship and innovation;
- Organisational support from both the private and public sector top management in promoting technology transfer, entrepreneurship and innovation;
- Organisations and government are required to provide clear intellectual property policies that clearly identify TTOs objectives and expectations;
- South Africa requires better established TTOs which over time can serve as a benchmark for other newly developing TTOs;
- South Africa requires constant 'champions' supplying innovation input which needs to be stimulated by the government and organisations;
- South Africa requires sufficient incentives with the necessary know-how in its policy structures to enable and facilitate technology transfer.

It can clearly be identified that a commercialising entity enabling the majority of the above-mentioned success factors will be very successful in commercialising the intellectual property and technology of public funded universities in South Africa.

2.3.3.3.2. COMMERCIALISING INHIBITING FACTORS

According to Alessandri *et al*. (2013) the following inhibiting factors were identified by TTOs in their national research survey:

- Marketing and branding awareness is lacking amongst researchers regarding the potential benefits from potentially commercialising their research and/or to create intellectual property;
- The filter capacity of TTOs in identifying 'low hanging fruits' and identifying promising early stage technologies and/or intellectual property;
- A lack of human capacity to manage TTOs causes insufficient monitoring of technology transfer activities limiting the potential of benefiting from 'low hanging fruits';
- A lack of industry networks causing inadequate interaction between TTOs, researchers, inventors entrepreneurs and industry partners;
- A serious financial gap of pre-seed, seed and early-stage funding for R&D and spin-off companies is severely inhibiting the commecialisation success.

- A lack of establishing and maintaining a pipeline of intellectual property, invention and technology development.

Other inhibiting factors were identified by Wolson (2007) as follows:

- **Limited Invention Disclosures:** A weak flow of invention disclosures can be practically due to the overburden of academics juggling administrative, teaching and research duties. Also, a lack of research funding levels and heterogeneous mix of funding causes complex research agreements limiting intellectual property ownership for commercialisation funding (financial roadmap e.g.venture capital financing).
- **High Costs Associated to Patenting:** New TTOs struggle budgeting and financing costly patent filings and prosecutions, especially international patents as is most of the times necessary due to the small South African market. Due to the lack of financing and budgets for patenting, researchers usually then rather use the limited funds for research.
- **Limited TTO Capacity:** A lack of human capital in terms of experienced technology transfer practitioners and specialised training in commercialisation is limited in South Africa. Long-term capacity building in developing commercialising and technology transfer specialists is required.
- **TTO Objectives and Expectations Ambiguity:** Clear objectives and expectations with regards to financial returns and support needs to be stipulated and communicated. Commercialisation doesn't happen overnight and especially takes a long period of time to develop research into a '*commercial commodity*'. In this regard, the various role players need to be clearly identified, and the system needs to be in place.
- **Challenging Fields for IP Management:** Certain fields such as life sciences are a difficult sector for the complexity of the intellectual property management and protecting. Additionally, some fields (e.g. Pharmaceutical) have difficulty producing revenue streams early on in the commercialisation process, making them a high-risk sectors.
- **Limited Licencing Opportunities:** Industry partners in South Africa are limited due to the price sensitive and relatively small market, making market opportunities and distribution channels for exploitation difficult, while there are limited investors for spin-off companies, especially at such early stages such as before pre-seed (basic research), seed and early stage spin-off companies.

2.3.3.3.3. COMMERCIALISING CHALLENGES

According to Alessandri *et al.* (2013) the following commercialising challenges were identified by TTOs in their national research survey:

- There are specifically difficult challenges in educating researchers and students when basic research, data and R&D have intellectual property potential especially aligned with the new IPR-PFRD Act;
- Marketing campaigns are necessary for intellectual property support, and financing awareness at the various universities has its own particular challenges;

- There are also challenges with establishing networking interaction technology transfer managers, researchers and students;
- Challenges regarding the capacity of understaffed TTOs to actively identify potential intellectual property opportunities;
- The IPR-PFRD Act itself contains numerous challenges in monitoring new intellectual property influx as capacity requirements;
- With a lack of staff in functioning the role of managing intellectual property, there are also challenges in capacity in performing roles such as patent searches in identifying opportunities.

2.3.4. FUNDING SUPPORT FOR START-UP BUSINESSES IN SOUTH AFRICA

This section discusses the access for start-up businesses to various funding support institutions that can be considered for the commercialisation of start-up businesses in South Africa. It will not include and discuss each organisation in detail or financing possibility, but will indicate an overview perspective of the access for business financing in South Africa as these aspects are largely discussed at greater detail in the report by Herrington *et al.* (2009) and other similar reports.

First, to understand funding support for start-up businesses, one must understand the different types of funding available and their mandates for investing in a start-up. This is conceptually illustrated in Figure 2.23 below, as studies have shown that different sources of financing, ranging from debt to equity financing, are associated to different types of start-up businesses based on their growth potential and potential rate of return (Bruno & Tyebjee, 1985; Herrington *et al*., 2009).

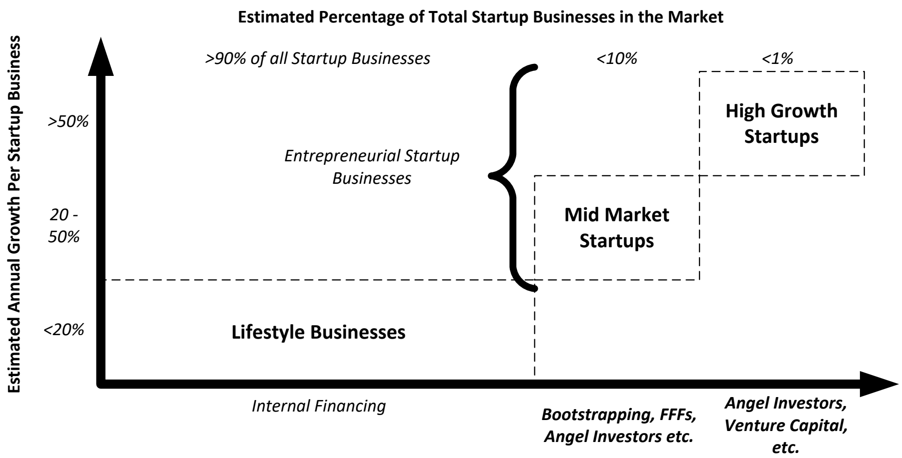

Figure 2.23: Categorising Different Types of Start-up businesses adapted from Bruno & Teybjee (1985) and Herrington *et al.* (2009)

It was also found that the particular stage of development of associated start-up business corresponds to different types of funding and has different rates of growth and returns associated with each stage. This is illustrated in Figure 2.24 below and is conceptually based to illustrate the difference between financing available at the different stages as the start-up business develops. Please note the role of internal financing (owner's capital) can also include a debt financing which most likely will require surety put on his personal capital.

Crowdfunding and other types of business financing can also be considered but is excluded in the conceptual illustration. It also important to note the business financial situation in terms of revenue, net income and cashflow. The highest risk in terms of business financing is at the earlier stages of pre-seed, seed and early stage. Therefore, additional and creative financing support is most required at those stages.

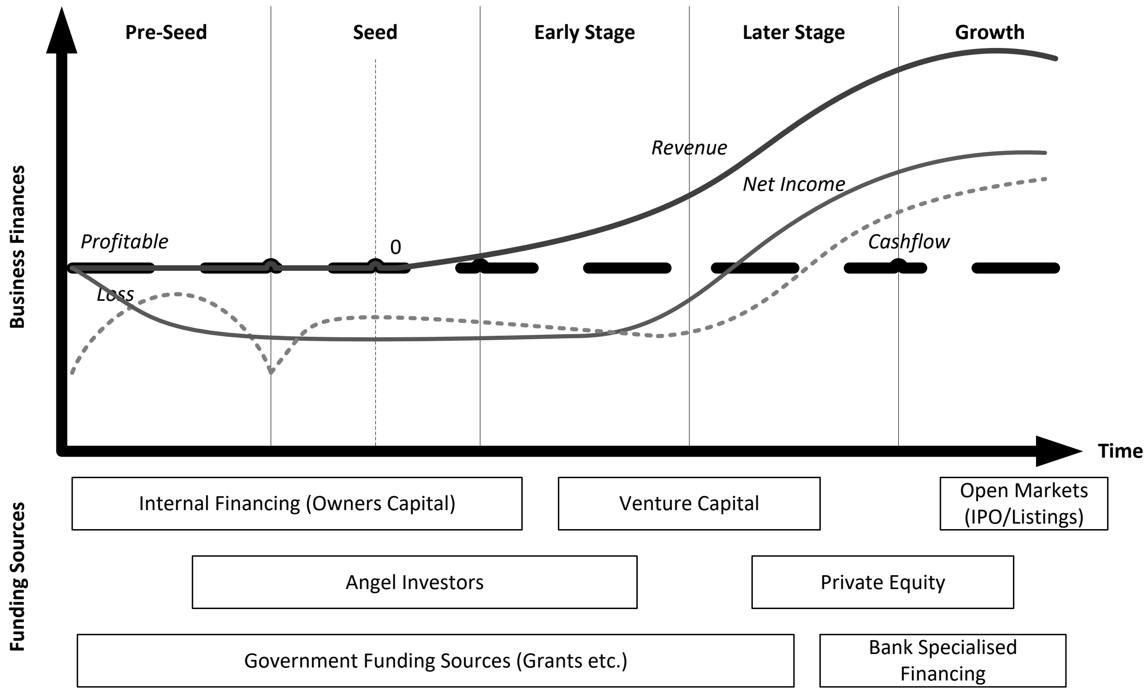

Figure 2.24: Different Funding Types at the Business Development Stages combined Smith *et al.* (2011, p. 20) and Van Zyl *et al.* (2013)

In Figure 2.25 below, the risk associated to different stages of the start-up business and the risk appetite of the investing organisations is conceptually illustrated. The key question to ask is why organisations want to invest in your business? Thie can briefly be answered as follows (Van Zyl, et al., 2013):

- ***Banks and debt financing:*** They are interested in the margins on debt financing (meaning interest), while diversifying their risk with the company or personal sureties used. Large commercial banks would also use leveraging techniques to reduce the risk of the debt financed.
- ***Industry Partners or Other Organisations***: They could be interested in merger and acquisitions (M&A), joint ventures (JVs) or strategic partnerships for growth, defensive, strategic positioning, etc. purposes.
- ***Government/Public Funding:*** They are interested in stimulating economic growth, repair market failures, R&D and/or possible investment returns.
- ***Asset managers:*** They are interested in dividends, and/or capital appreciation on the sale of shares especially on stock markets.
- ***Venture Capitalists:*** They are interested in medium- to high-growth start-up businesses to invest in at an early stage and then exit when capital appreciation on sale of shares is gained.

- ***Angel Investors:*** They are also interested in solid returns on capital appreciation, but could also be interested in the business and personal relationships as well as the involvement in the local business community.
- ***Other Funding Sources:*** This can include Mezzanine funds, microfinancing, etc. who are interested in various returns linked to the risk and reward ratio while crowdfunding can be based on local returns as well as local donations for the involvement in the local community.

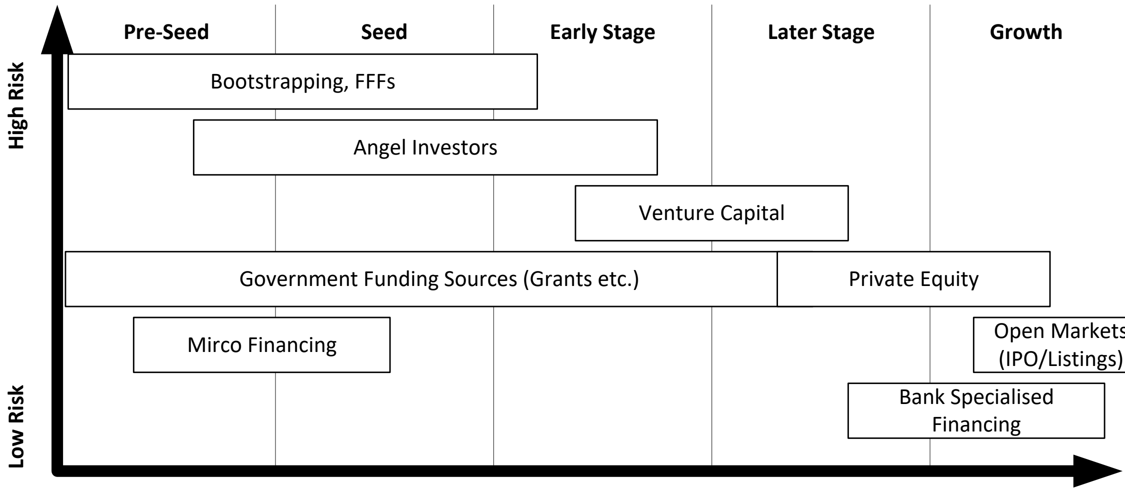

Figure 2.25: Risk Appetite of Funding Sources at the Different Development Stages adopted from Herrington *et al.* (2009)

The general development process of entrepreneurial start-up businesses with high-growth potential through the investment stages from bootstrapping through to initial public offer listing is illustrated in Figure 2.26 below. This concept is illustrated in a pyramid shape as the base indicates the number of start-up businesses decreases with the level of success.

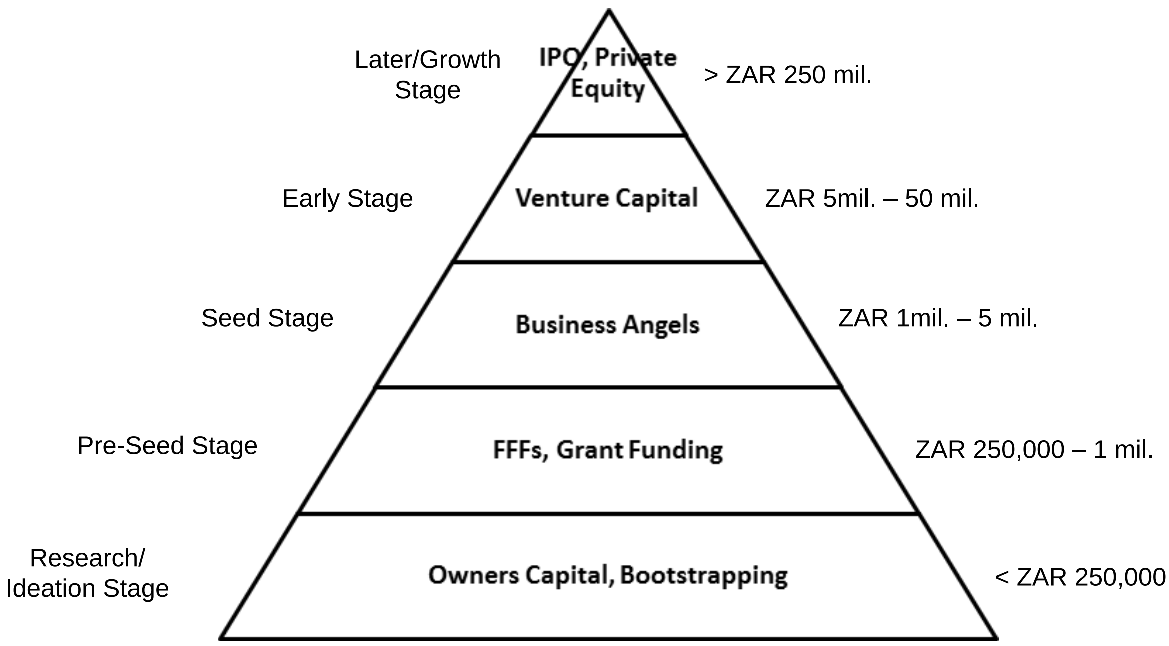

Figure 2.26: Conceptual Roadmap of the Start-up Business Development Process through the Investment Stage

While the above-mentioned illustrations indicate the various potential sources of financing to start-up businesses, there is evidence that there are various gaps in the South African ecosystem. In a survey by Omidyar Network & Monitor Group (2013) with 582 African entrepreneurs illustrated in Figure 2.27 below, the majority of entrepreneurs seem to use personal/family loans (owner's capital) to finance their start-up businesses while relatively very few other sources of funding is used.

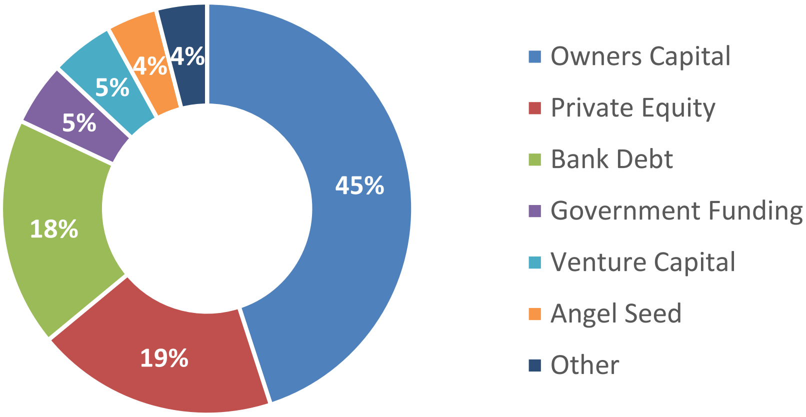

Figure 2.27: Main Sources of Funding in Africa adapted from Omidyar Network & Monitor Group (2013)

While South Africa is the powerhouse from a macroeconomic perspective in Africa, it performs relatively poorly in terms of entrepreneurship and supporting entrepreneurship in the country (Omidyar Network & Monitor Group, 2013, p. 41). It was reported that funding strategies in South Africa provide entrepreneurs with alternative funding sources than the traditional equity and debt financing, while equity funding is improving and has become more lucrative than debt financing. However, exit strategies remain limited and underperforming. An overview perspective of the various sources of funding for start-up businesses will be discussed in more detail below.

2.3.4.1. CROWDSOURCING AND CROWDFUNDING

C*rowdsourcing* and *crowdfunding* are two unique and creative methods that have evolved from the modern business age, whereby a collective effort of an individual using their network to pool in resources in support of their initiated project or in some cases, start-up business (Van Zyl, et al., 2013). Crowdsourcing is the process of obtaining resources required and can be seen as 'insourcing' whereby services; ideas or content are solicited from a 'crowd' or large group of people. Crowdfunding, on the other hand, is the process of obtaining and raising small momentary contributions from the 'crowd'.

Crowdsourcing and crowdfunding platforms are fundamentally open innovation platforms and are typically based on the internet whereby it can get easy exposure and reach a magnitude of people ('crowd'). Globally the crowdfunding industry has raised over US$5 billion worldwide in 2013 and has seen a dramatic exponential growth from previous years (Massolution, 2013). However, the leading continents in crowdfunding are North America and Europe which contribute the majority of the market share while crowdfunding in Africa has only accumulated to US$0.1 in total.

The stakeholders involved in crowdfunding are generally as follows:

- The project initiators are the people or organisation that requires funding seeking out a platform from which to raise the funding required.
- The crowds of people are the network of people willing to support projects or organisations.
- The platform (crowdfunding organisation website) which provides the crowds with projects that require funding.

There are different types of crowdfunding platform models (Business Partners Limited, 2014):

- ***Donation/Reward Crowdfunding:*** This type of platform model is aimed at gaining supporters that are motivated by social or personal reasons to donate into the project. Here the people invest in the 'feel good' experience rather than expecting a financial return. Most of the projects usually provide nonmonetary rewards as a token of good gesture for supporting their project. Other projects also use this as a marketing tool to launch new creative projects.
- ***Debt/Credit Based Crowdfunding*** (also known as microfinancing crowdfunding): Uses the principles of peer-to-peer lending whereby debt investment provides investors with their money plus interest back. This is a monetary-based model similar to banks lending money to their clients, expecting a return in the form of interest.
- ***Equity Crowdfunding:*** is where investors invest into an opportunity for exchange of equity. As the value in the project or start-up business grows, so does the value of the investor. However, this is at high risk as numerous new projects and start-up businesses fail. Key awareness is needed as to when returns on investment are expected, and possible exit for the investor is required. Another key challenge in South Africa is the legislation managing these transactions which do raise the issue of soliciting funds from the public.

For many years, the 'stokvel' principle[32] in South Africa has been used, especially amongst the poorer communities and can also be seen a form of crowdfunding. The online platforms that are well known both internationally and locally in South Africa are mentioned in Table 2.13 below.

Table 2.13: Popular Online Crowdfunding Platforms in South Africa (Business Partners Limited, 2014)

Online Platforms	Website	Notes
Well Known International		
Kickstarter	www.kickstarter.com	Largest global funding platform for creative projects.
Indie GoGo	www.indiegogo.com	International platform for musicians and videographers.
Well Known locally in South Africa		
Crowdinvest	www.crowdinvest.co.za	An accredited equity crowdfunding platform with established investors funding local projects.
FundFind	www.fundfind.co.za	A local rewards based crowdfunding platform aimed at providing South Africans a 'reason to dream again'.

[32] *This is where each member of the 'stokvel' invests equal amounts to the pool of funds whereby each month one member receives the full pool of funds to use and make a personal return from, or if agreed upon a return for the group members collectively.*

Startme	www.startme.co.za	A local rewards based crowdfunding platform categorising projects like agriculture, creative and entrepreneurial.
Rainfin	www.rainfin.com	A beta phase local peer-to-peer crowdlending platform connecting borrowers and lenders.
Thundafund	www.thundafund.com	A local rewards based crowdfunding platform where all projects can potentially be funded.

2.3.4.2. BOOTSTRAPPING, INTERNAL FINANCING AND OWNER'S CAPITAL

Bootstrapping is regarded as the purest form of entrepreneurship (Lahm & Little, 2005), while the process is defined by Roberts *et al.* (2006) as a "*multistage commitment of resources with a minimum commitment at each stage or decision point*". Meaning that bootstrapping is the process of financing a start-up business through exceedingly creative acquisitions and usage of resources to avoid giving off equity to traditional financing sources such as venture capital or bank loans. This is achieved through managing internal cashflow and being cautious with business expenses (Chistiansen & Porter, 2009).

In numerous studies it has been shown that the majority of start-up businesses are launched with limited owner's capital and used internal financing techniques (Roberts, 1991; Bhide, 1992; Freear, et al., 1995; Cole, et al., 2005). The concept of bootstrapping and its phenomenon is still limited in its understanding among academic literature (Lahm & Little, 2005), but Lahm & Little (2005, p. 6) provide a list of practical suggestions for bootstrapping a start-up business. Another list of creative and cash-friendly uses of resources are discussed in Herrington *et al.* (2009, p. 126).

While Van Zyl *et al. (*2013) argue that there are additional benefits in bootstrapping a start-up business on owner's capital as it shows that there is a commitment, 'the owners have skin in the game'. They further suggest it is valuable to investors who are willing to invest at a later stage, as the owner is willing to commit to his/her idea while the start-up develops a proof of concept and gains market traction which are all positive signs for investors.

Also note that internal financing can mean that the loan was taken out with the surety put on risk by the founders or equity partners in the start-up business. The surety could be a bond on their assets taken out at a local commercial bank as an example.

2.3.4.3. INFORMAL INVESTORS: ANGELS AND FFFs

The three F's in start-up business terms refers to the founders of the start-up business convincing their immediate network of friends, family and fools to invest in their business concept. These can be regarded as informal investors in a start-up business, but the extent of their investments depends on the particular network ties and experience to govern their involvement (Kotha & George, 2012). While there aren't abundant sources of literature on this particular topic, they can be regarded as informal investors and in many cases the vital sources of capital to pursue the creation of ventures.

Other informal investors are business angels who are affluent, private individuals that invest their personal capital as funding in exchange for equity shares in the start-up business or convertible debt (Van Zyl, *et al*., 2013). Angel investors also more often combine together, forming angel groups or networks whereby they share research and pool of investment capital. It is important to understand that angel investors don't just invest capital, but also provide additional benefits to the start-up business invested in. These can include the following (Herrington *et al.,* 2011; Van Zyl *et al*., 2013):

- Attracting Additional Investment
- Credibility
- Financial Advice & Controls
- Focus and Support
- Governance
- Management Expertise
- Networks (Market entry, sales, exit, etc.)
- Strategic Advice

Angel investments are at extremely high risk and are subject to shareholding dilution at future investment rounds, requiring potential start-up businesses to promise a very high return of investment as most angel investors will completely lose their investment if the start-up fails. In the case of angel groups or networks, they are more likely to use the portfolio effect to mitigate the risk of investment failure while also providing advice to their portfolio start-up business.

Globally there are over 730 angel groups/networks most of which are in North America and Europe, while in South Africa, angel investments are ad hoc and mainly reliant on the entrepreneur's personal networks (Cartens, 2012). Generally angel investments in South Africa, range from R100k to R5 million and are seen as pre-seed and seed funding rounds. In Table 2.14 below, a limited list of the well-known angel groups and networks in Africa and South Africa is provided.

It is difficult to measure the performance of the angel, angel groups and networks as there is a lack of data as this is usually an informal investment structure making it difficult to track. The lists provide some closure in the fact that there are active angel investors in South Africa, but it is still regarded as an emerging ecosystem with angel investors being hard to come by. Perhaps a future recommendation would be to establish a South African association of angel investors to not only accredit transparency and credibility of the informal investments but also to provide measurable data.

Table 2.14: List of Popular Angel Groups and Networks in Africa and South Arica

Online Platforms	Website	Notes
Well Known in Africa		
Angel Investment Network	www.africaangelsnetwork.com	Angel investment fund that invests in technology, media or telecom start-up businesses across Africa.
VC4Africa	www.vc4africa.biz	A large entrepreneurs' and investors' platform for start-up businesses across Africa with some funded start-up businesses.
Well Known Locally in South Africa		
Angel Investment Network	www.investmentnetwork.co.za	Claims to be largest South African angel investors platform with over 75 000 investors and over

		ZAR1 billion businesses/projects funded. However, not necessarily start-up businesses are listed and validated information.
AngelHub Ventures	www.angelhub.co.za	An angel seed fund investing into lean start-up businesses with disruptive business models and technologies. Some success stories.
Mzansi Gold	www.mzansigold.com	South African platform is connecting entrepreneurs and investors with no evident success stories.
Google Umbono	www.google.co.za/intl/en/umbono/index.html	A tech incubator is focusing on high-growth tech ventures aiming to scale to global markets.
Investors Network	www.investorsnetwork.co.za	South African investors platform for entrepreneurs and angel investors. Some success stories and facilities across South Africa.
Additional Platform		
Angel List	angel.co/south-africa/investors	An active global start-up businesses and investors platform which is geographically categorised and offers a host of services.

2.3.4.4. VENTURE CAPITAL

Venture capital (VC) funds are independent, private companies or organisations that are managed by venture capitalists. The VC funds generally run between seven and ten years by when they are expected to have acquired their initial invested capital plus additional high rates of return (Herrington, et al., 2009; Van Zyl, et al., 2013). Generally VC funds are managed by experienced venture capitalists, that are either regarded as generalists or specialists, but provides the following ranges of services to the start-up business invested in (Herrington, et al., 2009):

- Provide Capital investment in start-up businesses for scaling and expansion;
- Provide wisdom and experience to the start-up businesses;
- Provide assistance with business and financial administration;
- Provide assistance and guidance with various contract and technical agreement negotiations;
- Provide assistance and guidance in other fields such as counselling, insurance planning, risk management, etc.

It is clear that VC can be regarded as a highly valuable source of equity funding for start-up businesses as they possess a level of understanding for the risk appetite and scalability required by these start-up businesses (Herrington, et al., 2009). The growth is attained through the capital investment aimed at enabling radical global scaling (Van Zyl, *et al.,* 2013). VC's predominantly supply capital and other resources to high growth potential start-up businesses through the exchange of equity shares for capital aiming to achieve high rates of return (Harvard Business School, 1981, p. 1).

While the different VC models and important aspects regarding venture capitalists will be discussed in more detail in Chapter 3, a focus on South African VC funds and their activity will be considered. In South Africa, a list of VC funds can be found at Southern African Venture Capital & Private Equity Association (SAVCA)[33] and in Table 2.15 below, a few popular VC companies and platforms are listed.

Table 2.15: List[34] of Popular Venture Capital Companies in South Arica

Online Platforms	Website	Notes
4Di Capital	www.4dicapital.com	An independent seed- and early-stage technology venture capital company based in Cape Town with numerous investments.
Invenfin	www.invenfin.com	A VC investment company completely owned by Remgro Ltd. which invests in growing businesses with globally scalable potential, protectable IP and dynamic team.
Hasso Plattner Ventures	www.hp-ventures.co.za	Successful VC fund with numerous investments from their first fund of US$ 39 million.
Here Be Dragons	www.hbd.com	A private owned emerging market investment group with successful VC fund, but now inactive in the growth equity investment field.
Knife Capital	www.knifecap.com	Very successful VC fund formerly known as PoweredbyVC and also using Stock Markets as a mechanism for raising funding capital.
U-Start Africa	www.u-start.biz	International VC investment platform is investing in emerging economies with numerous partners.

In evaluating the maturity of the South African VC ecosystem, it is important to evaluate it from two perspectives which are the investments in start-up businesses, as well as the start-up business exits that occur. This adds an additional metric to the number of funds listed above.

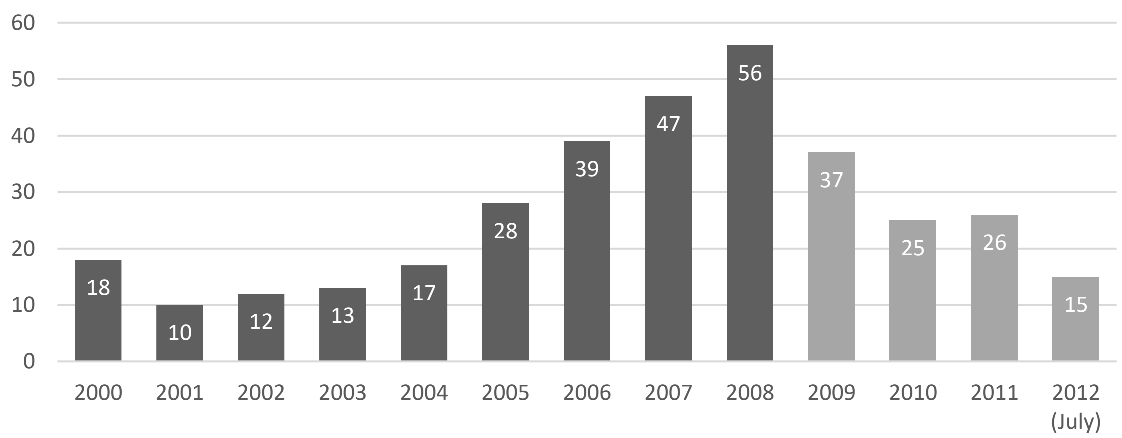

Figure 2.28: Number of Venture Capital Investment Transactions adapted from (Lamprecht & Van Der Walt, 2012)

[33] Note that both Venture Capital and Private Equity funds are listed on the SAVCA (2014) members' list. [Online] Availabe at http://www.savca.co.za/membership/member-directory/member-list-and-contact-details/full-members/ [Accessed on 30 August 2014].
[34] Another list of Venture Capital Funds is in an online article by Silicon Cape Initiative, 2014. *Venture Capital Investors*. [Online] Available at http://www.siliconcape.com/page/venture-capital-investors [Accessed on 30 August 2014].

In VC survey by Lamprecht & Van Der Walt (2012), the South African VC ecosystem was evaluated according to the various aspects of the VC industry. In Figure 2.28 and Table 2.16, the number of investment transactions per year in South Africa and the summary of the Venture Capital investment transactions is shown. The key highlights of the survey indicate the following:

- Since 2000 till 2008, the VC industry grew rapidly until the global recession which saw a global decrease in VC investments.
- Since 2009 till July 2012, a total of ZAR 0.83 billion was invested in the venture capital asset class with 11 active funds surveyed and 103 VC investment transactions.
- Also in this period, only 4% of the total investments made were for seed stage companies while the majority were for the start-up stage and onwards.
- The sectors of the VC investment transactions are fairly scattered across the industry sectors with the four predominant sectors being the telecoms, energy, software and medical devices and equipment sectors.
- In the survey period, there have also been 12 full exits and 4 partial exits with the most noteworthy exit being the VISA US$110 million acquisitions of the VC-funded Fundamo business.
- The average equity taken by the VC fund was averaged at 39.71% and the typical range seems to fall between 30% to 49% of early stage investment transactions, but depending on the investor, risk profile and other aspects, the equity stake can either increase above 50% or be below 15%.
- The type of VC funds and the number of investment transactions are mainly from government VC funds and general VC funds while a few angel investors and corporate VCs were also cited.
- The average investment opportunity seen by investors averaged at 274 opportunities per year per fund managers with the majority not fitting the stated mandate of the VC fund.
- The deal flow of opportunities also come predominantly from the VC fund manager's direct or indirect network.

Table 2.16: Summary of the Venture Capital Investment Transactions in South Africa adapted from Lamprecht & Van der Walt (2012)

Summary of Venture Capital Investment Transactions	2000–2010	2009–2012
Number of Venture Capital Fund Managers Investing in the Period	33	22
Number of Investment Transactions Made for the Period	**277**	**103***
By Government Backed VC Funds	26	-
By Angel Investors	54	-
By VC Fund Managers	197	-
Average Invested Amount Per Transaction	ZAR 10.5 mil.	ZAR 8.11 mil.
Total Amount Invested in Period	**ZAR 2.638 bil.**	**ZAR 0.835 bil.**
Total Amount Invested in Venture Capital Asset Class at end of Period	ZAR 2.324 bil.	ZAR 3.084 bil.

**no exact data on the type of investment transactions.*

2.3.4.5. GOVERNMENT FUNDING

Government funding is generally a subsidy awarded as either financial and/or support services to the economic sector (institutions, businesses and individuals) which are aimed at supporting a specific economic and social policy. These financial and/or support services are not necessarily subject to interest, equity sharing, payback or revenue sharing (Van Zyl, *et al.*, 2013).

The South African Government has early seen the purpose of promoting small business development and entrepreneurship and has established it as an objective across various governmental departments and even created specific departments to fulfil specific roles. This is evidenced above with highly active government VC funds and in Table 2.17 below, a list of government departments and institutions that financially support business development in South Africa.

Table 2.17: List[35] of Government Departments and Institutions Supporting Business Development[36] in South Arica (Herrington, et al., 2009)

Institutions	Website	Notes
Business Partners Ltd.[37]: • **Egoli Investments** • **e'Thekweni Investments** • **iKapa Investments** • **Business Partners/Khula Start-up Fund** • **Property Equity Fund**	www.businesspartners.co.za	Public Private Partnership fund between numerous private entities and the government, supporting enterprise development. General funds of ZAR 500 mil size looking for investment from ZAR 250 k to ZAR 20 mil at any stage, except the Start-up fund which is ZAR 150 mil specifically for black start-up businesses and the Property Equity fund for property general development.
Department of Trade & Industry: • **Aqua-culture Development & Enhancement Programme (ADEP)** • **Automotive Investment Scheme (AIS)** • **Black Business Supplier Development Programme (BBSDP)** • **Business Process Services (BPS)** • **Capital Projects FeasibilityProgramme (CPFP)** • ***Co-operative Incentive Scheme (CIS)***	www.thedti.gov.za	• Available to entities with primary, secondary and ancillary aquaculture projects for both fresh and marine water. • Available to entities in proving the automotive industry. • Available to black-owned businesses as a cost-sharing grant to improve their sustainability and competitiveness. • Three-year tax-exemption grant for creating employment through off-shore activities. • Cost-sharing grant of project feasibility studies of local manufacturing and export projects. • Cost-sharing grant (90:10) for establishing primary co-ops (5 or more members) to improve sustainability and competitiveness.

[35] Entrepreneur Magazine, 2014. *Governmnet Grants*. [Online] Available at http://www.entrepreneurmag.co.za/advice/funding/government-funding-funding/government-grants/ [Accessed on 30 August 2014].
[36] Additional lists of small business development support South Africa. ETU, 2014. *Small Business Development* [Online] Available at http://www.etu.org.za/toolbox/docs/government/sbd.html [Accessed on 30 August 2014]
[37] *Herrington et al. (2009, p. 140-142).*

Institutions	Website	Notes
• ***Incubation Support Programme (SIP)*** • **Manufacturing Investment Programme (MIP)**		• Available for the establishment of successful incubator enterprises for local economic development. • Cash reimbursable grant available to local- and foreign-owned manufacturers establishing expanding or new facilities.
Industrial Development Corporation (IDC)[38]	www.idc.co.za	Multiple strategic business units are supporting the creation of employment and economic development. Also additional special funding units.
Isivande Women's Fund (IWF)	www.thedti.gov.za	Financial support to existing businesses managed by women.
Khula Enterprise Finance Ltd.[39]**:** • **Khula Land Reform Empowerment Facility (LREF)** • **Khula Credit Indemnity Scheme** • **Multiple Joint Venture Funds**	www.khula.org.za	Multiple funds with three key mandate focus areas: • Improving SMEs access to financing; • Improving economic development impact; • Provide financial sustainability.
Gauteng Enterprise Propeller (GEP)	www.gep.co.za	Provide start-up, franchise and contract financing for economic development in Gauteng province.
National Empowerment Fund: • **Imbewu Fund** • **Corporate Fund** • **Strategic Project Fund**	www.nefcorp.co.za	Aimed at cultivating an entrepreneurial culture through debt, quasi-equity and equity financial support start-up businesses, franchise, procurement and community development projects.
National Youth Development Agency	www.nyda.gov.za	Funding support for young entrepreneurs between the age of 18 and 35 starting or growing businesses.
Support Programme for Industrial Innovation (SPII)	www.spii.co.za	Funding support for the promotion and development of technology development in South African industry.
Technology Innovation Agency: • **Patent Support Fund** • **Technology Development Fund** • **Youth Technology Innovation Fund** • **Industry Matching Fund** • **Design Innovation Seed Fund**	www.tia.gov.za	Providing pre-seed and seed funding support in the aim of economic development and commercialisation of competitive technology-based products and services in the sectors of advance manufacturing, agriculture, industrial biotechnology, health, mining, energy and ICT.

2.3.4.6. MICROFINANCING

Microfinancing or microlending[40] is a source of small amounts ('micro') of credit for low-income unemployed people, SMEs and entrepreneurs that lack normal access to commercial banks and related services. Typically there are two types of microfinancing relating to entrepreneurs and SMEs:

- ***Relationship-based banking:*** between entrepreneur and SMEs with the microfinancing institution;
- ***Group-based models:*** where several SMEs and/or entrepreneurs apply for microfinancing credit and other related services jointly as a group.

[38] *Herrington et al. (2009, p. 135-138).*
[39] *Herrington et al. (2009, p. 133).*
[40] Investopedia, 2014. *Definition of Microfinancing*. [Online] Available at http://www.investopedia.com/terms/m/microfinance.asp [Accessed on 25 August 2014].

Even though microfinancing has existed since the 1700s, entrepreneurs and SMEs in South Africa prior to 1992 resorted to pawnbrokers and/or informal systems such as burial societies, stokvels and rotating savings to access small amounts of credit. This was because commercial banks did not offer microlending credit as a service to its clients. The reason for this is that all the major banks' policies require personal security or collateral from the borrowers.

Since then, South Africa has established a Micro Finance Regulatory Council to somewhat add stability and formality to the industry. While the Usury Act Exemption Notice (1999) had a great impact on microfinancing in South Africa, care must be taken in dealing with the different institutions. The most well-known institutions are listed below in Table 2.18.The trends that emerged included the following (Herrington, et al., 2009):

- Increased microfinancing formalisation in the industry;
- New microfinancing institutions entered the market;
- Improved formal investments into the microfinancing industry.

Table 2.18: List of Microfinancing Institutions in South Arica

Institutions	Website	Notes
Blue Financial Services	www.blue.co.za	Listed on the JSE-AltX providing SMMEs that don't require start-up capital with loans ranging from ZAR 15 000 to ZAR 3 million depending on business type and size.
Khula Micro-Credit Outlets (MCOs)	www.khula.co.za	Outlets established in rural and peri-urban areas to women and business owners with microloans ranging from ZAR 350 to ZAR 3,500.
Marang Financial Services	www.marang.co.za	Focusing on providing microloans ranging from ZAR 500 and ZAR 10,000 to emerging entrepreneurs and marginalised communities.
Small Enterprise Foundation (SEF)	www.sef.co.za	Two established microfinancing funds for small businesses without any collateral with loans ranging from ZAR 800 to ZAR 10 000.
South African Micro-Finance Apex Fund (SAMAF)	www.thedti.gov.za/samaf.htm	Government company established to provide access microfinancing services and savings mobilisation of cooperatives to decrease poverty and unemployment.
Women's Development Businesses (WDB)	www.wdb.co.za	Targeting poor women in rural areas providing microloans and training with the objective of increasing household income.

2.3.4.7. COMMERCIAL AND MERCHANT BANKS

Debt financing from banks is financing in the form of a loan generally requiring collateral or securities in the form of capital assets or tangible assets. Other forms of debt financing include microfinancing (discussed in more detail above), specialised debt financing, leveraging and mezzanine debt financing.

The names of commercial and merchant banks are listed in Table 2.19 below. The differences between commercial and merchant banks are as follows:

- Commercial banks[41] are financial institutions providing financial services including accepting deposits, auto loans and credit, business loans, certificates of deposits, mortgage loans, savings accounts, etc.
- Merchant banks[42] are financial institutions that do not provide commercial banking services to the general public, but instead provide international financing, long-term loans and advice to companies, corporations, underwriting and wealthy individuals.

Table 2.19: List of Banking Institutions in South Arica

Institutions	Website	Institutions	Website
Commercial Banks:		**Merchant Banks:**	
African Development Bank	www.afdb.co.za	Investec Bank Ltd.	www.investec.com
Barclays ABSA	www.absa.co.za	Sasfin Bank Ltd.	www.sasfin.co.za
Capitec Bank	www.capitecbank.co.za	Rand Merchant Bank	www.rmb.co.za
First National Bank	www.fnb.co.za	Rennies Bank	www.renniesbank.co.za
Land Bank	www.landbank.co.za		
Nedbank	www.nedbank.co.za		
Standard Bank	www.standardbank.co.za		

While there are also foreign banks in South Africa, it is not the focus of this research study to evaluate debt financing in great depth. The key difference between equity and debt financing is summarised in Table 2.20 below and highlights the main advantages and disadvantages of the two types of financing.

Table 2.20: Summary of Equity versus Debt Financing (Herrington, et al., 2009)

Equity Financing		Debt Financing	
Advantages:	**Disadvantages:**	**Advantages:**	**Disadvantages:**
Less risky than a loan with no interest payments.	Investors dilute equity ownership or shareholding and take a percentage of profits.	Loan amount can vary based on required business need both short and long term.	Debt obligation is created and must be repaid within a given period.
Investors inject capital on long-term scaling of the business.	VC's expect high rates of return on investment.	Generally the loan principle and interests are known amounts.	Collateral or sureties are generally required by debt institutions.
No obligation to repay the capital if the business fails.	Investors generally expect exit within a given period after capital investment.	Ownership or shareholding is not diluted provided loan repayment.	Too much debt creates high risk and limits equity capital raising.
Cashflow at hand with investing capital and profits are not channelled in loan repayment.	Finding the right investors takes time and effort.	Loan interests are tax deductible.	High costs of loan repayments increase the time period to break-even.

[41] Investopedia, 2014. *Definition of Commercial Bank*. [Online] Available at http://www.investopedia.com/terms/c/commercialbank.asp [Accessed on 30 August 2014].
[42] Investopedia, 2014. *Definition of Merchant Bank*. [Online] Available at http://www.investopedia.com/terms/m/merchantbank.asp [Accessed on 30 August 2014].

Businesses are more credible and can tap into investor's network and management experience.	The debt institute has no interference if regular loan payments are made and the relationship ends once loan is repaid.	Interest repayments affect cash flow negatively. If Cash flow problems, business and sureties becomes vulnerable.

2.3.4.8. NGO SUPPORT AND CORPORATE SOCIAL INVESTMENTS

Non-Governmental Organisations (NGOs) are organisations that are not part of the government and are not conventionally driven for profit businesses. Similarly, there are not-for-profit businesses or organisations and other small businesses supporting enterprise development. In South Africa there are numerous such organisations in the form of NGOs, Section 21 companies and other small businesses. These businesses and organisations generally support enterprise development in the form of education and skills development, and specialised financial support for specific services. Similarly, corporate social investments have also recently been used for enterprise development and specifically for the improvement of social entrepreneurship. However, these organisations will not be discussed in more detail in this research study.

2.3.4.9. PRIVATE EQUITY AND STOCK EXCHANGE MARKETS

Private equity is a form of equity financing for the later stage (growth and development) and is generally through merger and acquisitions (buy-outs), management buy-ins or replacement capital with the investments aimed at gaining dividends, interest and capital gains as financial gains in the exit (Van Zyl, et al., 2013). The private equity (PE) industry[43] is far more established in South Africa than the VC industry, with far more investments and exits. The PE industry is valued at ZAR 162,2 billion in funds under management in 2013 with growth of 17% (KPMG & SAVCA, 2014) and contributes its success to the well established stock exchange market in South Africa.

In South Africa, the only stock exchange market is the Johannesburg Stock Exchange (JSE) with over 400 listed companies and a market capitalisation of over a US$1 trillion (at the end of 2013)[44] which makes it the largest in Africa and one of the world's twenty largest exchanges. It consists out of three boards, namely, the main board, AltX and the African Board. Start-up businesses raise funding through listing on the stock exchange market with an initial public offering (IPO) by exchanging its equity shares, whereby the public market trades in financial securities (Van Zyl, et al., 2013).

Around the world established ecosystem, stock exchange and second-tier capital markets are regarded as a viable exit mechanism for high growth start-up businesses (Jones & Mlambo, 2013). However, there is a poor environment in South Africa for start-up business to list which has over the years contributed to the few IPO

[43] More information on South Africa's Private Equity industry can be gathered from the survey reports by KPMG & SAVCA (2001 to 2014) and RisCura Fundamentals & SAVCA (2012 to 2014). [Online] Available at http://www.savca.co.za/research-and-resources/ [Accessed on 30 August 2014].
[44] JSE, 2014. History Company Overview. [Online] Available at https://www.jse.co.za/about/history-company-overview [Accessed on 30 August 2014].

exits (Zaaruka, et al., 2005; Van Zyl, et al., 2013). It can be argued that South Africa could benefit from establishing other competitive exchanges to rival the JSE.

For the purpose of this research study, only this brief overview of PE and stock markets in South Africa is required as the core focus is on the development of start-up business in the earlier stages where they are more vulnerable and the gaps of the valley of death seem to be far more severe.

2.3.4.10. OTHER DEVELOPMENT SUPPORT

While the lists of financial support for business development are mentioned above, there are numerous other business development opportunities available to start-up businesses in South Africa. These include awards and competitions; co-working spaces, business clusters and technology parks; and incubator and accelerator programmes. Each of these aspects has been drastically improved in recent years, and continuously more support platforms are established both from the private and public sector.

In particular, there is an increase in importance of business incubator and accelerator programmes which are designed to support the acceleration and/or successful development of entrepreneurial start-up businesses through an array of business support services and resources (Van Zyl, et al., 2013). These programmes will be discussed in more detail in Chapter 4.

When considering the stages of start-up business development, as mentioned above, the following development actions, support options and description of the necessities of each stage are discussed by Smith *et al.* (2011) and are summarised in Table 2.21 below.

2.4. CHAPTER SYNTHESIS

In this chapter, a literature review on innovation ecosystems and in particular, the innovation ecosystem of South Africa was conducted. It also included a review on the best practice and the role of different technology transfer models was also reviewed. The objective was to answer the SRQs defined for this chapter as listed in Table 1.1 and including SRQ:2.1-2.20.

The SRQs answered in this literature review, as well as their outcome and significance, are synthesised in Table 2.22 below. The significance of the answered SRQs is used in Chapter 6 in the development of the conceptual framework while the three objectives of this chapter (refer to Table 1.2) were successfully achieved as follows:

[SRO:2.1] ***Develop an understanding of the dynamics of the innovation ecosystem.***

The SRO:2.1 was achieved as the SRQ:2.1-2.9 was successfully reviewed, and the significance is the need for an innovation pipeline within an innovation ecosystem to reduce innovation gaps and support the innovation value chain.

[SRO:2.2] ***Determine the best practice and role of technology transfer models.***

The SRO:2.2 was achieved as the SRQ:2.10-2.13 was successfully reviewed and it was concluded that the spin-off companies play a significant role in developing an innovation ecosystems, while technology transfer offices do not provide a whole solution in supporting entrepreneurship and innovation.

[SRO:2.3] ***Develop an understanding of the dynamics of South Africa's innovation ecosystem.***

The SRO:2.3 was mostly achieved in successfully reviewing SRQ2.14-2.20, but due to lack of empirical evidence on the commercialising challenges and gaps in South Africa, structured interviews with industry experts are required. However, the review was successful in establishing the background for developing a conceptual framework based on South Africa's innovation ecosystem and more specifically the need for such an innovation pipeline.

Table 2.21: Standardised Progression of Start-up Businesses adapted from Smith *et al.* (2011) and Van Zyl *et al.* (2013), and combined with the Lean Start-up Methodology by Ries (2011)

Stage	Pre-Seed (Opportunity)	Seed (R&D)	Early Stage (Start-up)	Later Stage (Early Growth)	Growth (Rapid Growth)	Exit Strategy
Develop-ment Actions	Obtaining pre-seed financing; Assess opportunity; Assess strategic alternatives; Determine organisational structure and form; and Prepare a business case and model.	Obtain seed financing; Build research team Conduct R&D activities e.g.: Intellectual Property Protection; Minimum Viable Prototype; etc. Test market viability; and Update business case/model.	Obtain early stage (e.g. venture capital) financing; Assess/update business case/model; Initiate revenue generation; Initiate production; Build starting inventory; Build sales and marketing team; Acquire facilities and equipment.	Obtain later stage financing; Work toward breakeven revenue; Expand team as needed; Expand facilities as needed; Assess/update business case/model.	Obtain further scaling financing, if needed; Work towards proven viability; Expand team as needed; Expand facilities as needed; Build track record for harvest; Assess/update business case/model.	Obtain continuing financing (e.g. IPO, acquisition, buyout); Early investors harvest; Assess/update business case/model.
Support Options	Gov. grants; Owners capital, FFF & Microfin., etc.	Crowd funding, Angels & Incubators	Angels, VCs & Incubators	Angels, VCs & Accelerators	VCs, Private Equity & Bank Specialised Financing.	Bank Specialised Financing & Stock Markets.
Necessity Descrip-tion	All activities involving conceptualising the business case without incurring significant expenses.	All R&D activities in developing the minimum viable prototype	All activities that initiate and relate to revenue generating such as productions, marketing, sales, etc.	All activities during the previous stages until sales are sufficient to break-even in cashflow.	All the activities after break-even and before sustainable viability is established. Potential early exit also possible.	All activities are related to establishing continuing financing and enabling early investors to harvest. Formulation and implementation of an exit strategy.
Decision-making	Continue to next stage (persevere); Modify concept (pivot); and Abandon (perish).	Continue to next stage (persevere); Extend stage/financing (optimise/persevere); Modify R&D strategy (pivot); and Abandon (perish).	Continue to next stage (persevere); Modify the process/financing (pivot); and Abandon (perish).	Continue to next stage (persevere); Extend stage/financing (optimise/persevere); and Abandon (perish).	Continue to next stage (persevere); Extend stage/financing (optimise/persevere); and Abandon (perish).	Choose the best exit strategy.

Table 2.22: Synthesis of the Sub-research Questions and the Related Literature Review of Chapter 2

Ref. Code	Sub-research Questions	Related Section	Outcome Achieved	Significance
SRQ:2.1	What is an innovation ecosystem?	§2.2.1	Yes	A deeper understanding of the dynamics of innovation ecosystems and the need for developing an innovation pipeline. **FDC: 1.3** A framework enabling the reduction in innovation capital gaps to support and further enable the innovation value chain.
SRQ:2.2	What is the function and role of innovation ecosystem?	§2.2	Yes	
SRQ:2.3	What is the value chain of the innovation ecosystem?	§2.2.3	Yes	
SRQ:2.4	What is the role of entrepreneurial start-up businesses in the innovation ecosystem?	§2.2.7	Yes	
SRQ:2.5	What is the life cycle of innovation as defined by the innovation ecosystem?	§2.2.4	Yes	
SRQ:2.6	What is the valley of death?	§2.2.4	Yes	**FDC: 1.1** A framework focused on the innovation output and improved innovation efficiency. **FDC: 1.2** A framework supporting the innovation value chain and acting as a key enabler with its specific innovation process. **FDC: 1.4** A framework that enables elements of an entrepreneurial university and a shift towards an entrepreneurial university paradigm.
SRQ:2.7	What are the general commercialising challenges in an innovation ecosystem?	§2.2.5	Yes	
SRQ:2.8	What is the role and functions of universities in an innovation ecosystem?	§2.2.5-7	Yes	
SRQ:2.9	What is the role of universities in commercialising intellectual property?	§2.2.5-6	Yes	
SRQ:2.10	What is the role and function of Technology Transfer offices?	§2.2.6.2	Yes	**FDC: 1.5** A framework that improves the spin-off businesses that are created from intellectual property from public funded universities in South Africa.
SRQ:2.11	What are the different Technology Transfer office structures?	§2.2.6.1	Yes	
SRQ:2.12	What are the performance measurements and requirements of Universities and Technology Transfer Offices commercialising intellectual property?	§2.2.6.3	Partially Yes	
SRQ:2.13	What are the challenges and detriments for Technology Transfer Offices commercialising intellectual property?	§2.2.6.2 & §2.2.5	Yes	
SRQ:2.14	What are the dynamics of South African innovation ecosystem?	§2.3.1	Yes	The significance of evaluating South Africa's innovation ecosystem is to develop an understanding of the ecosystem and support the input analysis required for the application of the case study.
SRQ:2.15	What are the public funded universities producing innovation output in South Africa?	§2.3.2	Yes	
SRQ:2.16	What are the various role players in commercialising intellectual property in South Africa?	§2.3.3	Yes	

Ref. Code	Sub-research Questions	Related Section	Outcome Achieved	Significance
SRQ:2.17	What are the funding support for start-up businesses in South Africa?	§2.3.4	Yes	
SRQ:2.18	What are the development support for start-up businesses in South Africa?	§2.3.4.10	Partially Yes	
SRQ:2.19	What are the challenges and detriments for start-up businesses (entrepreneurial) in South Africa's ecosystem?	§2.3.4	Partially Yes, Chapters 4 & 7	
SRQ:2.20	What is the valley of death in South Africa?	§2.3.4	Partially Yes, Chapters 4 & 7	

3 Innovation and Venture Capital Models

This literature review focuses on innovation and venture capital models. It includes an overview of the dynamics of innovation models and processes, as well as the dynamics of venture capital and their respective models. The review evaluates the best practice models and defines the tools and concepts required for the framework.

3.1. INTRODUCTION

In a rapidly changing world, continuous innovation is essential for maintaining a competitive advantage and a necessity for the survival of a company. However, not all inventions are successful in the market while most never even get launched. It becomes important to understand the dynamics of the various models industry is using to evaluate best practice.

A comparison between various innovation models and venture capital models will be discussed in this chapter, and a synthesis of the findings will evaluate the best practice. The purpose is to provide an overview of the dynamics of innovation models and processes as well as the dynamics of venture capital and their respective models. The literature review evaluates the best practice between innovation and venture capital models. It also defines the tools and concepts required for the framework.

The SRQs set for this chapter are defined in Table 1.1, and include two sets of SRQs whereby the SRQ:3.1–3.7 set focuses on innovation models and SRQ:3.8–16 set focuses on venture capital models. The subsequent objective is to **[SRO:3.0]** ***determine the best practices between innovation and venture capital models*** (refer to Table 1.2) which is aims to achieve in this literature review.

3.2. INNOVATION MATTERS

An extensive body of literature exists on defining innovation, its approaches, processes and even the managing of innovation. This literature body even goes as far as describing the process of managing an idea through to commercialising the idea in the market (Trott, 2005; Tidd & Bessant, 2009), *but why does innovation matters?*

Today, markets are ever-changing, technological advancements are continuous forthcoming and dynamics of the modern business world require organisations to be more flexible and effective in sustaining their competitive advantage (Bornemann, et al., 2003; Marr *et al*., 2004; Hayes, 2010).

This is evident as the average lifespan of most of the largest corporations and organisations in the world has decreased drastically since the early 1900s until now (Foster, 2012). Since the original Fortune 500[45] list in 1955, with nearly 2 000 large corporations and organisations listed, only 61 of the organisations still appear on the list in the year 2014. According to Perry (2014), almost 88% of the organisations from 1955 have either merged, gone bankrupt or still exist, but unrecognisable, forgotten organisations have fallen from the list. In recent global surveys by PwC[46], over 1 200 CEOs of the fastest growing companies globally were interviewed with 79% of the CEOs saying that innovation is the driving force to improve efficiencies and competitive advantage, while 78%

[45] Fry, E. 2014. *What happened to the first Fortune 500?* [Online] Available at http://fortune.com/2014/06/02/first-fortune-500/ [Accessed on 15 August 2014]

[46] On p.10 the term, '*ambidextrous innovation*' was defined as innovation gaining both efficiency and differentiation gains in the report by PricewaterhouseCoopers, 2011. *14th Annual Global CEO Survey*. [Online] Available at http://www.pwc.com/gx/en/ceo-survey/pdf/14th-annual-global-ceo-survey.pdf [Accessed on 18 August 2014].

said that they expect new revenues. In addition, 86% percent of CEOs[47] recognised that there is a need to change the capacity of their innovation and R&D within their fast-growing global companies. It is notable that innovation has become very important to numerous organisations' strategies to gain competitive advantage.

In a study by Berth (1993), he evaluated 116 enterprises and their respective business units in Germany and concluded that only 0.5% of original ideas are successful, while only 2.9% of funded projects are successful. This is also consistent as Javelin (2014) similarly found that 98% of product launches and start-up businesses fail. This creates an innovation-funnelling paradigm illustrating the high risks and percentage of failure that are associated with innovation. In Figure 3.1, the innovation-funnelling paradigm is illustrated with the results from the work-study (Du Preez, *et al*., 2013, p. 50).

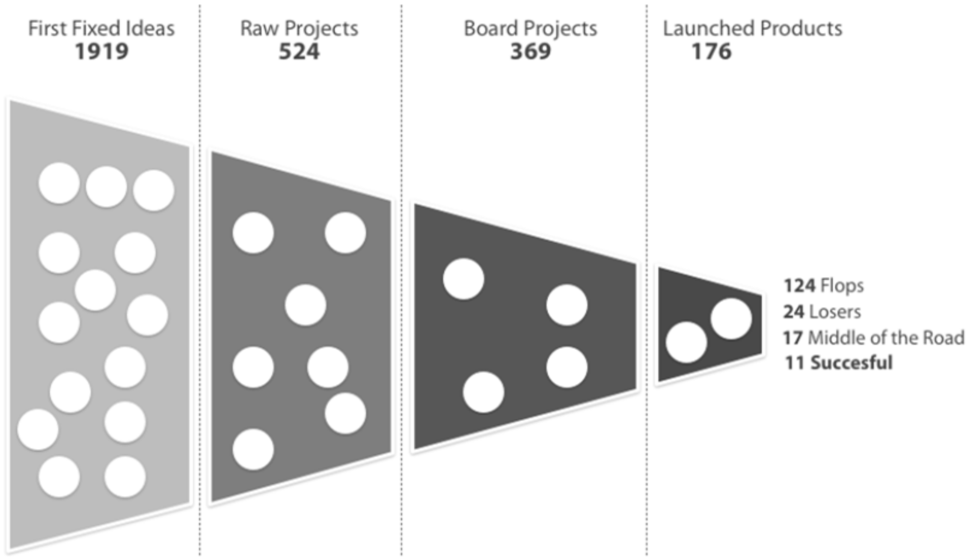

Figure 3.1: The Innovation Funnelling Paradigm by Berth (1993) adapted from Du Preez *et al*. (2013)

It is evident that even large organisations fail, but why do some fail while others thrive? Kalb (2013) argues that innovation is the common key ingredient that differentiates between organisations that fail from those on the brink of failure achieving great success. Tidd & Bessant (2009, p. 11) argue that an organisation's competitive advantage is not solely dependent on innovation, innovation does fundamentally provide a strategic advantage to the organisation which can sustain its competitive advantage.

Tidd & Bessant (2009) also argue the importance of innovation, from an organisation's perspective, which increasingly translates into national economic growth. This is further emphasised by Baumol (2002), who states boldly that innovation can effectively be accredited for almost all the economic growth since the eighteenth century.

[47] On p.14, findings from PricewaterhouseCoopers, 2014. *16th Annual Global CEO Survey*. [Online] Available at http://www.pwc.com/gx/en/ceo-survey/2014/assets/pwc-17th-annual-global-ceo-survey-jan-2014.pdf [Accessed on 18 August 2014].

The question that arises is whether innovation is, therefore, just limited to large organisations or can any organisation innovate? Rupert Murdoch[48] is quoted saying: *"The world is changing very fast. Big will not beat small anymore. It will be the fast beating the slow."*

In a survey by Statistic Canada (2006), the following key factors were identified as characteristics from successful small to medium enterprises (SMEs):

(1) The key critical success factor was consistently found to be *innovation*,

(2) Innovation typically enables SMEs to *sustain superior growth* rates and achieve *greater success* than the SMEs that don't innovate, and

(3) Innovative SMEs are increasingly *more profitable* after gaining market share than the SMEs that don't innovate.

It can be concluded that innovation matters to organisations, large or small, to help sustain a competitive advantage through strategically aligning their strategic initiatives with their innovation development. It is important to note that this is not the only source of competitive advantage of the organisation, but a critical one in order to sustain superior growth and to become more profitable.

3.2.1.1. DEFINING INNOVATION AND INNOVATIVE APPROACHES

Ames (1961), although critical, warns researchers of the term innovation, stating that "*innovation has come to mean all things to all men, and the careful student should perhaps avoid it wherever possible, using instead some other term*".

Of key importance here is to define firstly what innovation is not. Here are a few considerations about innovation:

- *An idea by itself is not innovation, it is worthless, but an idea combined with successful execution can change the world* (Steimle, 2013).
- *Innovation is not creativity; it is about execution as ideas are converted into successful businesses* (Govindarajan & Trimble, 2010).
- *Innovation is not just an invention or technology; it is an attitude and approach of working* (Shaindlin, 2013; (de Lecaros-Aquise, 2014).
- *Innovation is not the 'Holy Grail' as innovation needs to move away from an ideology towards a process* (Seelos & Mair, 2012).

In an article by Dance (2008), over 30 definitions of innovation were reviewed, and it was concluded that innovation is creating value for the execution of a 'fresh' or creative idea. For this paper, we will define the

[48] *Rupert Murdoch is the Chairman and CEO of News Corporation and was quoted in the IBM Global CEO Study of 2006.*

importance of innovation as the process of creating an invention and then the commercialisation of the invention into the market. This is simplistically illustrated in the equation below.

Equation 3.1: $$\textit{Innovation} = \textit{Invention} + \textit{Commercialisation}$$

From the equation above, the invention is defined as the process whereby every new product or process, or service originates from a new idea addressing customer needs or problems. According to Sheu (2009), there are three types of approaches for solving innovation problems as follows:

(1) ***Eureka Moment[49] or 'A flash of genius':*** This is not a primary approach to solving innovation problems as a solution(s) occurs during a flash of genius and even sometimes as accidental. Examples of such legendary moments in history are Archimedes' eureka moment discovering buoyancy, and Newton's eureka moment discovering gravity. However, not a large percentage of the world's population are geniuses capable of such inspirational discoveries.

(2) ***Empirical Path or Edisonian Approach[50]:*** This approach is characterised by trial and error or by a brainstorming approach to discover the solution rather than a systematic theoretical approach. Its largest drawback is that is exceedingly dependent on '*luck*' rather than considering situations with possible optimal solutions.

(3) ***Methodical Path or Systematic Approach:*** This approach uses a systematic process to reveal the total solution space and to speedily analyse and converge to an optimal solution. This allows for a more inclusive analysis of the solution space and selection of the optimal solution. The main differences between systematic and empirical approaches are graphically illustrated in Figure 3.2 below. When considering how to manage innovation, a systematic or methodical approach is more relevant.

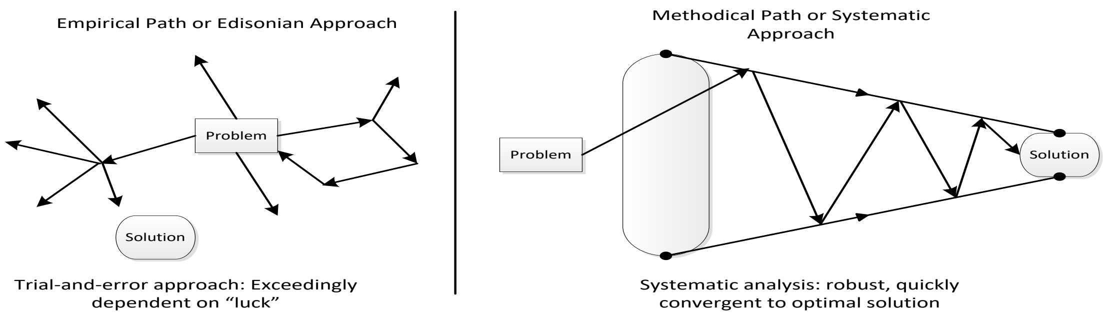

Figure 3.2: The Difference between Systematic and Empirical Approaches adapted from Sheu (2009)

[49] Numerous great eureka moments can be found in history as famous inspirational moments. The following source provides a historical background of such events. [Online] Available at: http://www.magazine.utoronto.ca/autumn-2005/great-eureka-moments-in-history-famous-inspirational-moments/ [Accessed 25 October 2013].

[50] Article by Edisonian Website. Thomas Edison and the Invention of the Light Bulb. [Online] Available at http://edisonian.weebly.com/the-edisonian-approach.html [Accessed 25 October 2013].

3.2.1.2. TYPES OF INNOVATION

In defining the approach to sourcing innovation, it is important to briefly address the different types of innovation. In literature, there is a wide array of different types of innovations and their effects. In this section, the different types of innovation will only be described briefly.

The first scope of innovation types is named the four P's of innovation space which essential describes different changes that could occur, provided in a framework of the innovation space map for any organisation (Tidd & Bessant, 2009). The four P's stand for the following categories, and each criterion is scaled by the 'degree of novelty' described as between increment and radical innovation:

- ***Product Innovation:*** changes to the organisation's products or services (e.g. new product development).
- ***Process Innovation:*** changes to the organisation's systems creating and delivering the organisations products or services (e.g. manufacturing or supply chain).
- ***Position Innovation:*** changes to the organisation's market position and/or brand identity through introducing the products/services in a new and different context (e.g. brand building, or marketing).
- ***Paradigm Innovation:*** changes to the core conceptual models that the organisation frames itself (e.g. business model innovation or organisation culture).
- ***Incremental Innovation:*** changes to 'doing things fundamentally better'.
- ***Radical Innovation:*** changes to 'doing things fundamentally differently'.

This is a useful tool for exploring opportunities for innovation in the organisation and is illustrated in Figure 3.3 below (Tidd & Bessant, 2009).

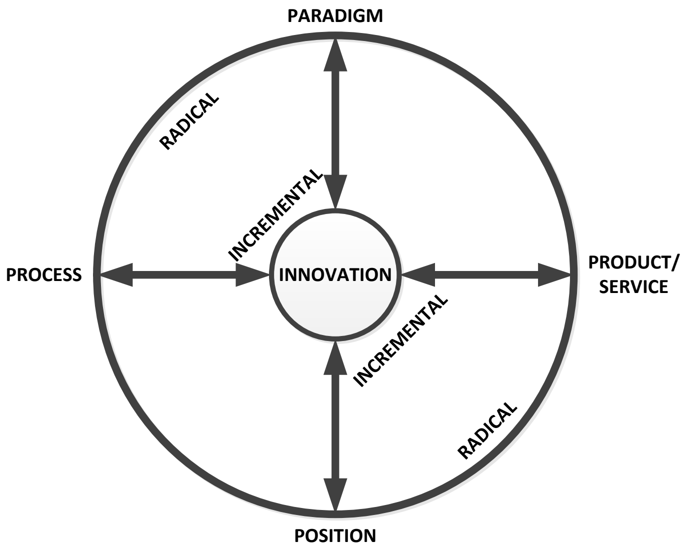

Figure 3.3: The Four P's of Innovation Space adopted from Tidd & Bessant (2009)

The basic conceptual perspectives of two innovation matrixes define another scope of innovation types. The first is by Satell (2012) and another by Rothaermel (2012) which are illustrated in Figure 3.4 and Figure 3.5 below, respectively. The innovation matrix by Satell (2012) defines the innovation types by a simple two-by-two matrix with the axis defined as problem definition and domain definition with each axis is measured by how well they are defined (refer to Figure 3.4).

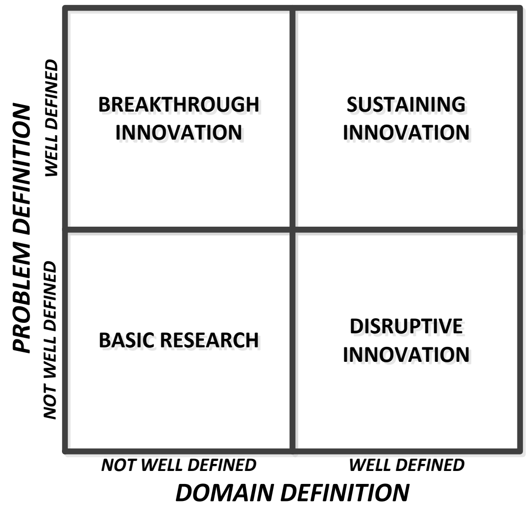

Figure 3.4: Innovation Matrix adopted from Satell (2012)

The innovation matrix by Rothaermel (2012) defines the innovation types by a simple two-by-two matrix that combines markets and technologies where each axis is measured by the degree of newness (refer to Figure 3.5 below for illustration).

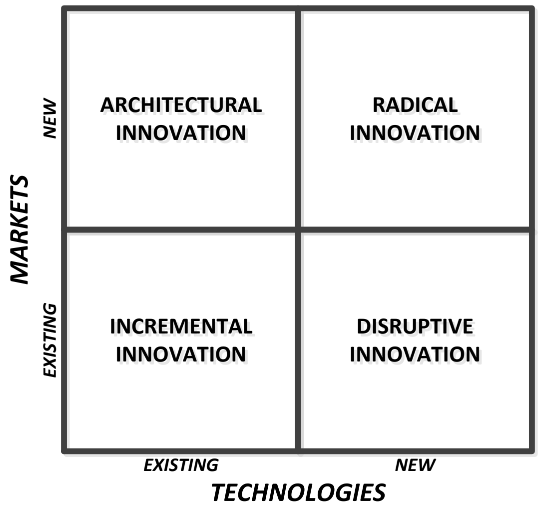

Figure 3.5: Innovation Matrix adopted from Rothaermel (2012)

However, there are also other aspects defining different innovation types that exist and some are listed in Table 3.1 below. In the field of innovation, there is a tendency for the use of the term to have come to mean everything and anything. Furthermore, numerous innovation types are specialised subfamilies of each other, making the bombardment of terms even more unbearable. For the purpose of this research thesis, these innovation types will not all be used and considered in the framework development process, but rather the focus will be on the innovation process.

Table 3.1: List of Innovation Types Defined in Literature[51]

Innovation Types	Source	Innovation Types	Source
Architectural Innovation	(Rothaermel, 2012)	**Frugal Innovation**	(Radjou, et al., 2012)
Basic Research	(Satell, 2012)	**Impossible/Possible Innovation**	(Musk, 2013)
Blue Ocean Strategy/New Market Innovation	(Kim & Mauborgne, 2005), (Nielson, 2014)	**Incremental Innovation**	(Tidd & Bessant, 2009)
Breakthrough Innovation	(Nielson, 2014)	**Management Innovation**	(Sniukas, 2009)
Business Model Innovation	(Osterwalder, et al., 2009)	**Open Source/ Crowdsourcing/Open Innovation**	(Chesbrough, 2003)
Continuous/Evolutionary/ Sustaining Innovation	(Satell, 2012)	**Process/Operational/ Supply Chain Innovation**	(Tidd & Bessant, 2009)
Customer Based/User Led/ Experience Innovation	(Kolk, 2013)	**Red Ocean Strategy Innovation**	(Kim & Mauborgne, 2005)
Discontinuous/Revolutionary/ Radical innovation	(Rothaermel, 2012)	**Service Innovation**	(Miles, 2000).
Disruptive Innovation	(Tidd & Bessant, 2009)	**Strategic Innovation**	(Sniukas, 2009)

The last innovation aspect that is required to be investigated is the timing of innovation, otherwise known as innovation life cycles. This concept was explained in relation to the 'valley of death' specifically related to the commercialisation of innovation in Chapter 2. However, in this innovation life cycle model, different emphasis is put on different innovation types over time. This is illustrated in Figure 5 below. This becomes a crucial part in effectively sustaining a continuous innovation process in an organisation.

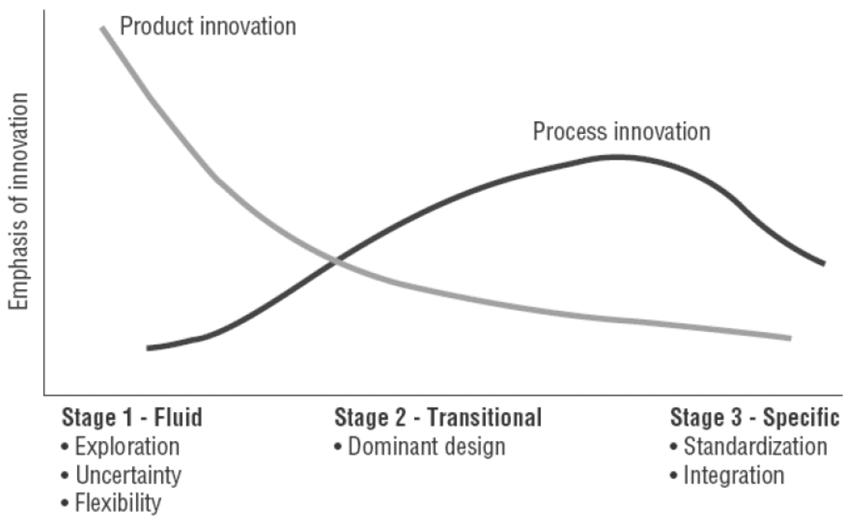

Figure 3.6: Innovation Life Cycle Model adopted from Abernathy & Utterback (1972) and Tidd & Bessant (2009)

[51] *Note that not every source and innovation type was factually determined in academic literature.*

3.2.1.3. INNOVATION MANAGEMENT

It is clear that innovation matters and that innovation can be developed through a systematic approach that can be managed. This is the growing field of innovation management where an organisation seizes internal and external opportunities through using creativity and engineering to create value for the organisation from new ideas, products, services and/or processes (Kelly & Kranzburg, 1978). The field of innovation management has become imperative to organisations and is rooted in the three pillars of innovation, which are competency, strategy, and management (Satell, 2012).

The role of innovation management is to utilise the tools available in the innovation processes that can be integrated into the organisation, technology and market (Trott, 2005). In literature, numerous innovation process models and tools exist which will be discussed in the following section in more detail to evaluate best practices in innovation management.

3.3. INNOVATION PROCESS MODELS

There is an extensive corpus of literature on innovation process models and to choose a specific model to compare becomes difficult as each company implements an innovation process to develop its unique value proposition through taking ideas to market. Innovation process models can loosely be categorised as either linear stage/phase models or non-linear cyclical models (Hildrum, 2007).

In the literature on innovation process models, certain models became well known and used throughout academia. Included in the research are well-renowned models such as Rothwell's five generations, Eversheim's w-model, systematic innovation and creative process models, innovation value chain models, the fugle innovation process, and open innovation. These innovation models will be discussed in more detail below to help define the benefits and drawbacks of the models and their respective processes to manage innovation from idea to market.

3.3.1. LINEAR INNOVATION, STAGE-GATE, COUPLING AND INTEGRATION MODELS

The uncomplicated linear innovation model has a profound historical background as one of the first theoretical frameworks developed to explain the relation between science and technology, and their impact in the economy. According to some studies, the original source of the linear innovation model comes directly from the Vannevar Bush's Science: *The Endless Frontier* (1945).[52]

[52] Godin, B., 2005. *The Linear Model of Innovation: The Historical Construction of an Analytical Framework*, Canada, CSIIC, p. 5.

A study by the leading author, B Godin (2005) found that the linear model developed over time and in three steps that correspond to three policy priorities or preoccupations as follows (refer to Figure 3.7 below):

(1) ***Basic research:*** Public support for research by universities;

(2) ***Development:*** Technology and its strategic importance for the industry;

(3) ***Diffusion:*** Economical and societal impact of the research and technology.

Figure 3.7: The Original Linear Innovation Model adapted from Godin (2005)

Since the first mention of a linear model conceptually, there have been various models publicised with variations in stages or phases added or changed[53]. A more modern adaption to the sequence mentioned above is found in the OECD literature[54], and the three-stage innovation process illustrated below by Figure 2 (Godin, 2005). This version is more generally accepted as '*conventional*'[55] and '*common*'[56].

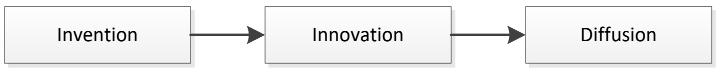

Figure 3.8: The Innovation Process of the Linear Innovation Model adapted from Godin (2005)

The first stage of invention is defined as the development of a new product, process or system, and how the new idea is reduced to practice. The second stage of innovation is defined as the commercialisation of the invention. The third stage of diffusion is defined as how the innovation disseminates in the industry.

Two other important and popular versions of the linear innovation model are known as the '*technology push*' model and the '*market pull*' model developed by one of the pioneers in industrial innovation, Roy Rothwell (Godin & Lane, 2013). His research is extensively discussed in the literature, and it mainly focused on high growth potential technology start-ups with his models used to defining corporate innovation management strategy. His first and second generation of linear innovation models explain innovation as either '*pushed*' by science or technology or 'pulled' by the needs of the market (refer to Figure 4 below).

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[53] For a summary of the taxonomies of innovation refer to Godin, B., 2005. *The Linear Model of Innovation: The Historical Construction of an Analytical Framework*, Canada: CSIIC, p. 32.
[54] OECD, 1966. *Government and Technical Innovation*, Paris: OECD, p. 9.
[55] Little A.D., 1963. *Patterns and Problems of Technical Innovation in American Industry*, Washington: NSF, p. 6.
[56] US Department of Commerce, 1967. *Technological Innovation: Its Environment and Management*, Washington: USGPO, p. 9.

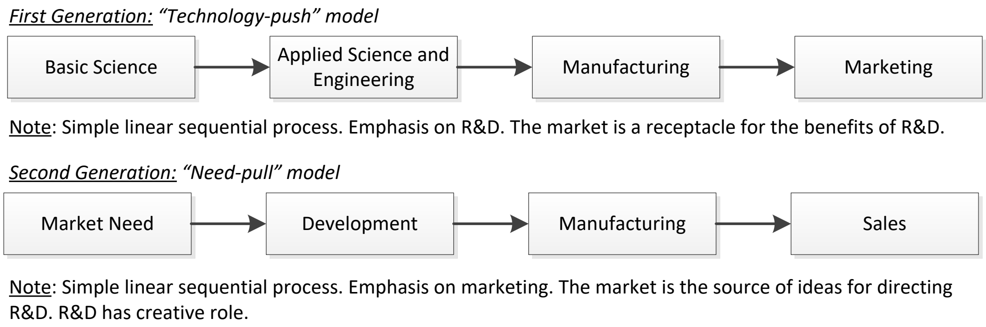

Figure 3.9: Rothwell's (1985) First and Second Generations of Linear Innovation Models

According to Buyse (2012), technology push generation in the 1950 to mid-1960s caused companies to focus predominantly on breakthrough science with overemphasis on research and development (R&D) that saw the market as a receptacle. This approach failed to incorporate market adoption, only until a late stage in the innovation process. The market pull generation in the mid-1960 to early 1970s was more a reactive approach due to increasing competition and overemphasised on market-driven improvements or incremental innovation rather than radical innovation (Rothwell & Zegveld, 1985).

Despite the success of the technology push and market pull models; numerous authors have raised criticisms concerning the linearity of the model for misrepresenting the complex nature and direction of factors in innovation (Kline & Rosenberg, 1986). Subsequently the linear innovation models have been dismissed as it is being subsumed under multidimensional models with feedback loops taking precedent popularity (Godin & Lane, 2013; Godin, 2013).

Rothwell's success was stunted from the 1970s to the mid-1980s with the persistent stagflation leading to a reduction in operation costs as the central theme that led to the '*coupling model*' (Rothwell & Zegveld, 1985). In Figure 5 below, the coupling model illustrates that technological innovation derives from technological opportunities ('*push*') and market needs ('*pull*'). The innovation process remains sequential but has feedback loops. The key is the balance between R&D and marketing with an emphasis on the interface between the two. Berkhout*et al.* (2006) criticised the 'open R&D models' (third generation models) as overemphasising technical aspects such as product and process innovation, while neglecting the non-technical aspects such as market and organisation innovation.

Similarly, Kline and Rosenberg (1986) proposed an alternative model called the chain-linked model that in contrast to the linear model describes innovation as continuous cyclic processes forming iterative feedback loops. The innovation process is seen as complex and nonlinear, running parallel interdependent paths to each other such as a marketplace, R&D, production processes and social impact.

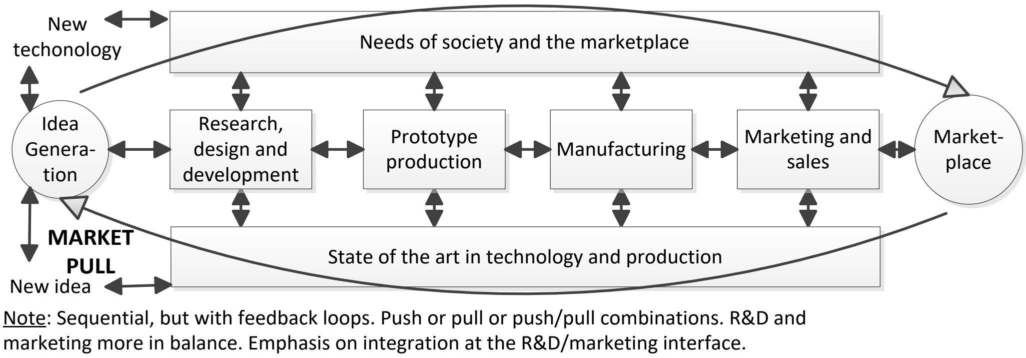

Figure 3.10: Rothwell & Zegveld (1985) Third-Generation Innovation Model adapted from Du Preez and Louw (2008), Buyers (2012), and Godin and Lane (2013)

Another well-known sequential or linear innovation process model is the Stage-Gate system by Cooper (1990) which divides the product innovation process into phases or stages separated by gates acting as decision points. The gatekeeper (typically a manager or steering committee) at each gate has specific criteria whereby the continuation of the process is decided on to minimise early stage risks. The gate decision is examined on a set of prescribed objectives predefined for preceding phases which are based on the information available at the time and usually includes the business case, available business resources, and risk analysis. The main advantage of this process is that it ensures quality in the innovation process and the gates ensure comprehensiveness, not allowing key actions to be omitted (Du Preez & Louw, 2008).

The model illustrated in Figure 3.11 has been further adapted into five stages plus the idea or discovery stage and five gates preceding each phase (refer to Figure 3.11 below), and is more commonly known as the traditional phase/stage-gate model. After receiving the '*go-ahead*' by the gatekeeper, each stage has a cross-functional project team that undertakes prescribed activities. According to a PDMA study[57], the stage-gate model is implemented in almost 70% of product developing organisations in the United States of America. However, Du Preez & Louw (2008) regarded the gates as "*too rigorous, especially in the early stages of idea and concept generation*". The process remains sequential and linear with few, if any, iterative feedback loops. Another critique is that the stage-gate system is geared towards improving the incremental innovation process, but for radical innovation a more flexible and iterative feedback system is required to commercialise the idea in the market under high uncertainty.

In 2008, Cooper developed his next generation of the stage-gate model that includes better governance methods with clear gatekeeper rules of engagement, less bureaucracy and includes learner gates. This next generation also includes scalability aimed at managing different sizes and types of projects. Additionally, more flexibility and adaptability can be achieved using the spiral development (using more iterative feedback loops) and simultaneous execution (using coupling and integration methods) version (Cooper, 2008).

[57] Barczak, G. *et al.*, 2009. *Perspective: Trends and Drivers of Success in NPD Practises: Results of the 2003 PDMA Best Practices Study*, Product Innovation Management, 26 (1), p. 3-23.

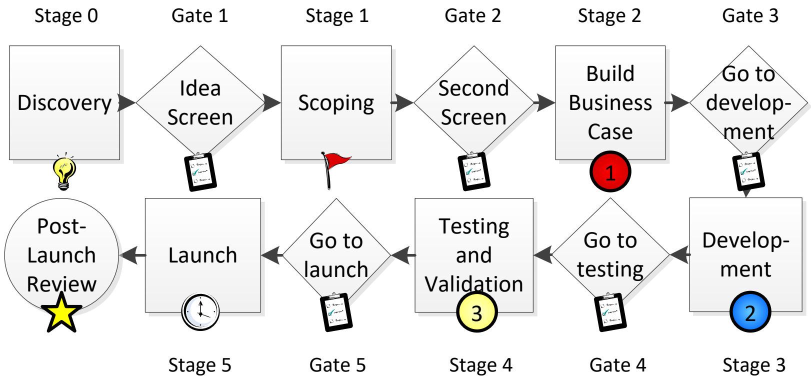

Figure 3.11: An Overview of a Typical Stage-Gate System developed by Cooper (1990)

The Eversheim (2002) W-model [58] can be seen as another sequential stage-gate model with a continuous cyclical loop that iterates innovation activities for a strategic purpose. It integrates seven procedure-stages as illustrated in Figure 3.12 below, with the last stage of the W-model being the transfer of the created product concepts into the operations of organisations for the long-term future (Baessler, et al., 2002). This completed process is called the "*Innovation Roadmap*". The Innovation Roadmap identifies promising immediate innovation, as well as future innovations that at a later stage can be investigated in detail. Sheu (2009) disputes that the W-model is limited in explaining the actual implementation process and the process to further exploit the development of new products and technologies.

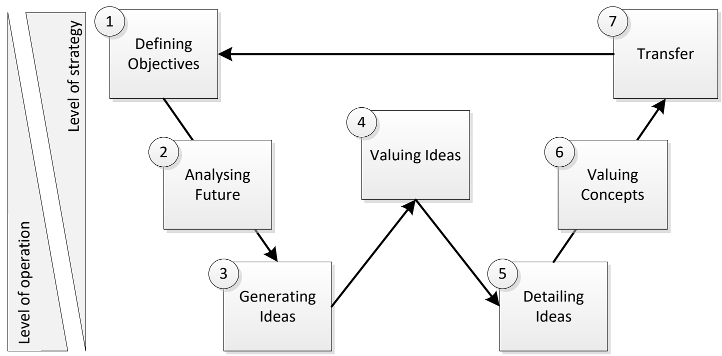

Figure 3.12: The W-Model of Innovation Developed by Eversheim (2002)

The Collaborative Innovation process is another relevant coupling innovation process model that was developed by Zeidner & Woods (2000) from the United Technologies Research Centre (refer to Figure 3.13 below). This model has a strong focus on the conceptual design stage using quality function deployment and a strong problem-formulation technique from the systematic innovation tool called TRIZ[59] (Du Preez & Louw, 2008). Similar to the other models, one of the main drawbacks is that it lacks a strong focus on the commercialisation phase deploying the innovation and for further development after the comprehensive conceptual stage.

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[58] *Other contributors to this process innovation model is Brandenburg (2002).*

[59] TRIZ is an acronym roughly translated from a Russian phrase "*Teoriya Resheniya Izobreatatelskikh Zadatch*" into English as the "*Theory of Inventive Problem Solving*" (Sheu, 2009).

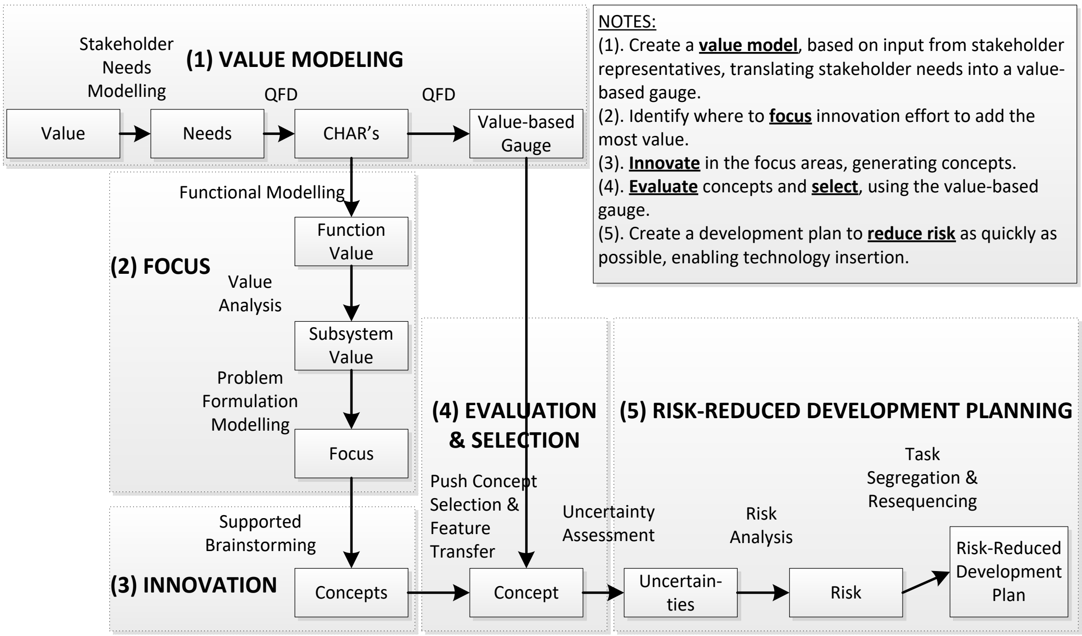


Figure 3.13: The Collaborative Innovation Process by Zeidner& Woods (2000)

From the early 80s to the mid-90s, product life cycles became a core focus, especially in reducing the time span of the innovation process. With the previous generations of innovation process models all lacking functional integration, Rothwell (1992) developed his fourth generation with parallel development across the organisation's functional teams (refer to Figure 3.14 below). The shift from a linear sequential to a parallel development process while integrating concurrent learning from key suppliers (upstream) and leading customers (downstream), placed more emphasis on the role of feedback. However, Du Preez and Louw (2008) argued that the functional interactive model did not inclusively describe the innovation process as a whole, and the disintegration led to improved:

- horizontal strategy in R&D alliances and collaborations consortia;
- vertical strategy in supplier relationships;
- external relationships between Small to Medium Enterprises (SMEs) with small and large firms;
- internal cross-functional and parallel integration development.

Another fourth-generation innovation model to consider is the Minnesota Innovation Research Program (MIRP) model published in 1986 based on 14 longitudinal case studies of innovation processes (Van de Ven & Scott-Poole, 1990). According to Hildrum (2007), MIRP focused on the sequence of steps and cycles taking an idea to market, with each cycle consisting of three periods, being an initiation period, a development period and an implementation period. Each period is distinguished by its particular process characteristics and is illustrated in Figure 3.15 below (Hildrum, 2007).

It is noteworthy that numerous innovations are developed from the interaction between the market and the innovation team. Du Preez and Louw (2008) argued that the introduction of an idea into the marketplace needs to be adapted, and continual improvement should be part of the innovation process. They also contended that a limitation of the MIRP model "*is that it stops the innovation process prior to implementation*" (Du Preez & Louw, 2008).

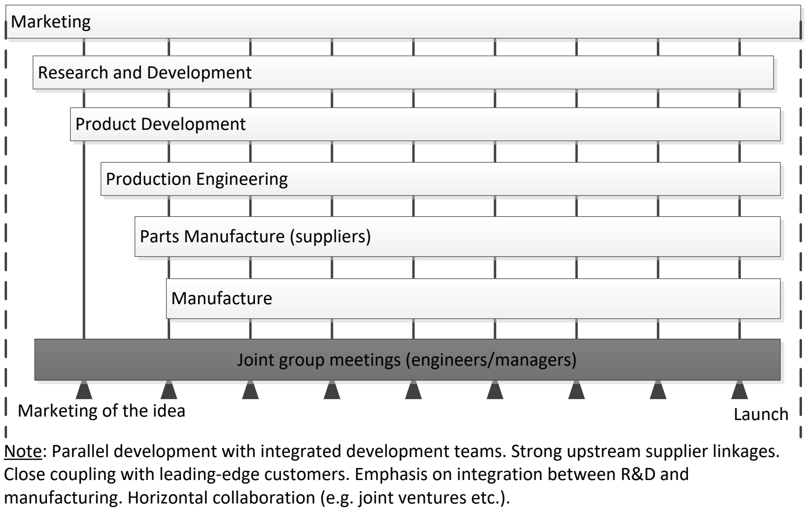


Figure 3.14: Rothwell'S Fourth-Generation Innovation Model adapted from Rothwell (1995), and Godin & Lane (2013)

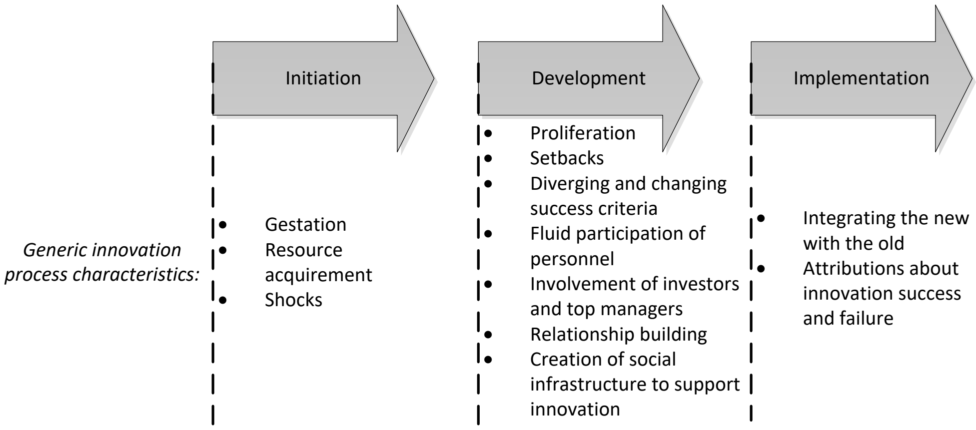


Figure 3.15: Key Characteristics of the MIRP Innovation Process Cycle adapted from Hildrum (2007)

From the 1990s onward, the fifth generation of innovation process models attempted to explain the complexity of the innovation process. Globalisation and international organisations realised that the central theme and constraint for organisations became resource management throughout the innovation process. In order for the process to remain flexible and speedy in development, a system integration and network model was considered (Buyse, 2012). This is because accelerated innovation is increasingly becoming a more important factor in sustaining organisations' competitiveness, especially in industries where high rates of technology change and short product life cycles are encountered. However, Rothwell (1994) reasoned that accelerated innovation increases development costs.

The fifth-generation models emphasise both vertical (suppliers and customers involved throughout the innovation process) and horizontal linkages (e.g. collaborations, alliances, consortia and joint ventures). Rothwell (1994) stated that his fourth-generation model is the foundation of the fifth and that the only major enhancement is the powerful electronic toolkit that improves operations efficiency (refer to Figure 3.16 below).

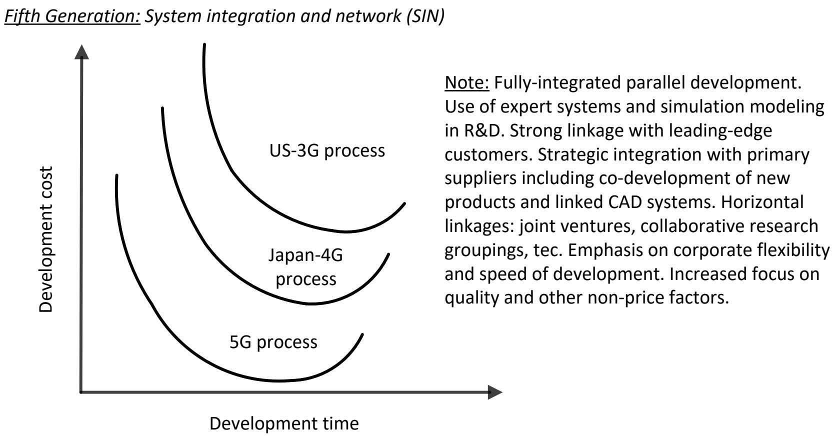


Figure 3.16: Product Development Time/Cost Relationships for 3G, 4G and 5G Innovation Processes adapted from Gupta & Wileman (1990, p. 12), and Rothwell (1994)

Key aspects of the system integration and network models are: What is the impact of the external environment, and how effectively can the organisation communicate with the external environment? The organisation needs to manage the innovation within a network consisting both of internal and external stakeholders. This can be seen as a business ecosystem within which the organisation and all the role players operate. A good example of such a model was developed by Trott (2005) and is illustrated in Figure 3.17 below.

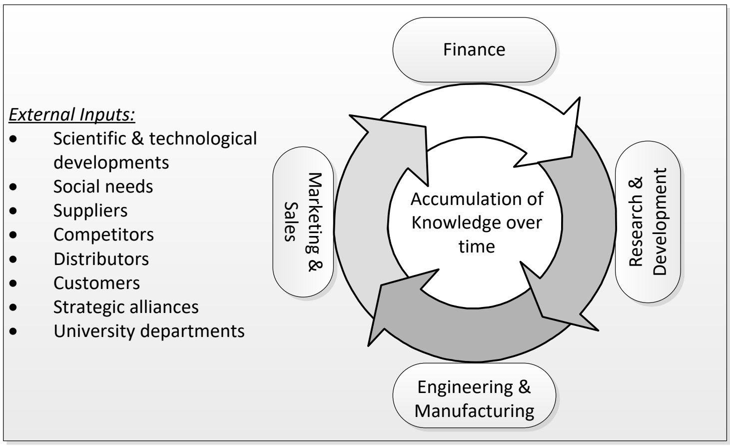


Figure 3.17: A Network Innovation Model Developed by Trott (2005)

3.3.2. SYSTEMATIC CREATIVITY AND INNOVATION PROCESSES

After the development of the fourth- and fifth-generation innovation process models, a series of more modern innovation process models was developed that is found relevant to include as they approached the innovation process differently. A good case is the author, Sheu (2009), who proposed a Systematic Innovation Process (SIP) after evaluating and improving various similar processes, such as Mann (2002) Systematic Creativity Process (SCP) and Philips Domestic Appliances and Personal Care (PDAPC) unit of Singapore (2001) presented a SIP.

Darrell L Mann[60] can be regarded as a leading author in TRIZ and in his book, Hands-On Systematic Innovation (2002), he developed a four-step and phase SCP illustrated in Figure 3.18. His SCP emphasised that the concept needs to be adapted, and the TRIZ tools need to be selected to generate solutions. This is a conflict-based model where TRIZ tools are applied to support the decision-making. Mann's models have similar limitations to other innovation models. Firstly, Mann's model neglects early-stage opportunity definition to filter through new ideas and concepts. Secondly, it lacks important subsequent stages in the commercialisation aspect of innovation, specifically in the implementation and exploitation of new product development. (Sheu, 2009)

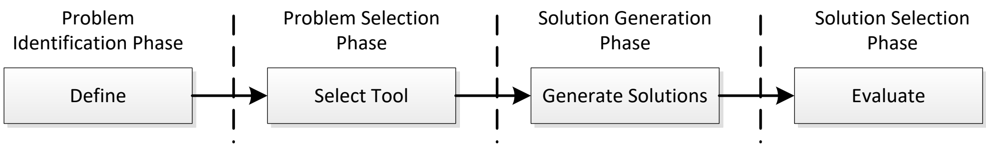


Figure 3.18: Mann (2002) Four-step and Phase Systematic Creativity Process adapted from Sheu (2009)

The other SIP model is the PDAPC, which developed a five-step process as illustrated in Figure 3.19 below. The process starts with developing a Technology Roadmap, which defines the pull and push factors for future R&D. This is followed by the Innovation Creation Process, which develops working prototypes from technological opportunities and consumer needs, and tests the feasibility of concepts. Then the Product Architecture stage is where new concepts and functional prototypes are developed into standard technical modules taking into consideration flexible and lean manufacturing design aspects. The management of new products is done via the Product Creation Process stage that reviews, evaluates and decides on whether a project is to be continued or not. Multidisciplinary project teams manage this entire process in an integrated and parallel process in an engineering environment. The SIP is a good framework for present product development processes but neglects development tools and how the technology will be implemented and exploited in the market. (Sheu, 2009)

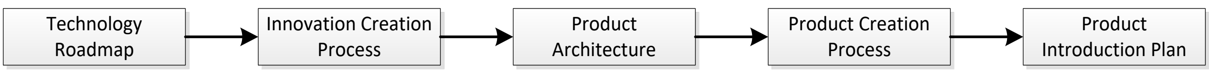


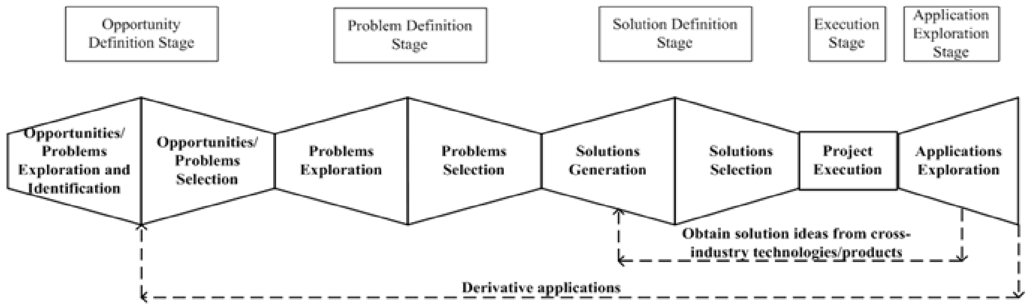
Figure 3.19: Philips Domestic Appliances & Personal Care Unit Singapore (2001) Systematic Innovation Process adapted from Sheu (2009)

The SIP model developed by Sheu (2009) was based on observations of various models and how their innovative product and process development takes place. His model offers a logical framework through the suggested five stages from problem/opportunity definition through to application exploration (refer to Figure 3.20). Taking into consideration the lack of resource tools recommended by the SCP and PDAPC models, Sheu's SIP model integrated various tools and knowledge (including TRIZ and non-TRIZ tools) to facilitate the process of innovation

[60] <u>D.L. Mann is a renowned innovator and academic:</u>

- *Books:*
  - *Hand-On Systematic Innovation, 2002, CREAX Press, Belgium.*
  - *Systematic Innovation: Beginner Level Workshop, 2007, IFR Press, Clevedon, UK.*
- *US Patents:*
  - *Air intakes for gas turbine engines (US Patent 5,139,545, 1992)*
  - *Particle separation (US Patent 5,498,273, 1996)*
- *As well as numerous publications on TRIZ.*

for synergetic utilisation. This allows the series of stages and phases of the SIP model to link planned business processes with business opportunity identification and technology details for across-industry application exploitation of newly developed technology/tools/products (Sheu, 2009). However, it lacks iterative feedback loops from market and customer needs, leaving it to a late execution and application exploration stage.



	Divergent	Convergent	Divergent	Convergent	Divergent	Convergent		Divergent
	Opportunities /Projects (1)	The Right Projects (2)	Problems (3)	The Right Problem (4)	Solutions (5)	The best solution (set) (6)	(7)	Opportunities /Projects (8)
TRIZ tools	▪ 9/12 Windows ▪ Ideal Final Results (IFR) ▪ Ideal Final Attributes (IFA) ▪ Problem Hierarchy	▪ Resource Analysis ▪ S-Curve Analysis	▪ 9/12 Windows ▪ IFA ▪ FAA ▪ EvPot Anal. ▪ STIC ▪ Problem Hierarchy ▪ Root Contradiction Analysis	▪ Substance-Field Analysis ▪ S-Curve Analysis	▪ Inventive Prin. ▪ Inventive Std. ▪ Sep/Tran P. ▪ Trends ▪ Trimming ▪ Resources ▪ Patent DB ▪ Func./Attr DB ▪ SLP ▪ AFD	▪ S-Curve Analysis		
Non-TRIZ tools	▪ VOC-Voice of Customer ▪ QFD-Quality Function Deployment ▪ Omega Life Views (OLV) ▪ PercepMap	▪ Benefit Analysis ▪ Constraint Analysis ▪ Feasibility Study	▪ OLV ▪ PercepMap ▪ Red Team Analysis ▪ Kepner-Tregoe method ▪ Root Cause Analysis	▪ Red Team Analysis ▪ Kepner-Tregoe method ▪ Cost-Benefit Analysis ▪ Feasibility Study	▪ Lateral Thinking ▪ SCAMPER ▪ Oblique Strategies ▪ Root Cause Analysis	▪ Multi-Criteria Decision Analysis ▪ Feature Transfer ▪ Axiomatic Design ▪ 6 Sigma ▪ Lean	▪ Proj. Mgmt .Tools ▪ 6 σ ▪ Lean	▪ VOC/QFD ▪ Product Platform Analysis ▪ Product-Technology Roadmap

Figure 3.20: Systematic Innovation Process and Tools adapted from Sheu (2009)

Another very inclusive fifth-generation innovation process model is the Creative Factor Systems Innovation Model, developed by Galanakis (2006), which uses a systems thinking approach (refer to Figure 3.21 illustrated below). The model allows for the organisation to be centred in-between the organisation's internal and external factors. The model strongly incorporates the push-pull model developed by Rothwell (1985), but with three phases on which the core innovation process is constructed. These three phases are integrated as follows:

(1) The knowledge creation process phase uses public and/or industrial research as the foundation for idea generation essential for the second phase;

(2) The new product design and development phase transforms the knowledge and ideas generated through product development and manufacturing into new products;

(3) Finally, the product success phase uses the new products developed and tests their competency in the market, through checking the product's functional competencies and the organisation's competencies with regards to quality, price and timing.

Tsai and Childs (2009) published an article on the differences between TRIZ, design processes and creative problem-solving processes, focusing primarily on creative thinking and the use of iteration. They also comprehensively compared various traditional design processes and existing systems for implementing TRIZ[61]. Furthermore, they developed the BRIGHT innovation model, which uses creative thinking and iteration to enhance the usability of TRIZ.

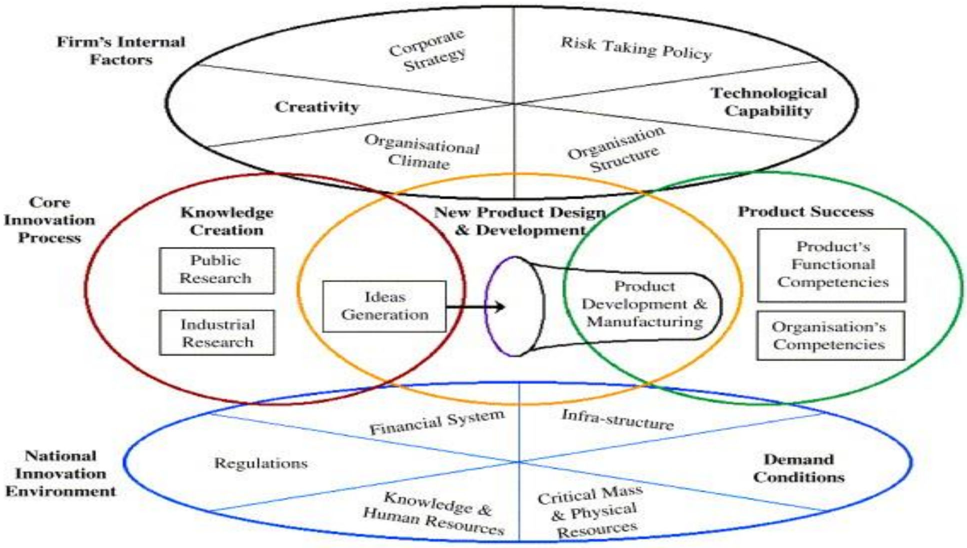


Figure 3.21: The Systems Thinking Innovation Model Developed by Galanakis (2006)

3.3.3. INNOVATION VALUE CHAIN AND OPEN INNOVATION MODELS

In the modern era of innovation process models, new concepts started focusing more readily on the commercialisation of innovation. In 2007, Hansen and Birkinshaw developed their innovation value chain model comprising of three phases: Idea Generation, Idea Conversion and Idea Diffusion (refer to Figure 3.22).

These three phases clearly explain and relate to the definition of innovation illustrated in Equation 1. The purpose of the Idea Generation phase is to use various sources (internal, external and cross-unit) to generate ideas. The second phase then focuses on screening and funding ideas to convert into viable products, services and/or businesses. The last phase is where ideas are developed and diffused internally and externally throughout the company to receive idea validation.

[61] *In the Tsai and Childs (2009), TRIZ: Incorporating the BRIGHT Process in Design article, Table 2 shows a comparison between the traditional design process and existing schemes for implementing TRIZ.*

	Idea Generation			Idea Conversion		Idea Diffusion
	In-house	Cross-pollination	External	Selection	Development	Spread
KEY QUESTIONS	Do people in our unit create good ideas on their own?	Do we create good ideas by working across the company?	Do we source enough good ideas from outside the firm?	Are we good at screening and funding new ideas?	Are we good at turning ideas into businesses and best practices?	Are we good at diffusing developed ideas across the company?
KEY PERFORMANCE INDICATORS	Number of high-quality ideas generated within a unit.	Number of high-quality ideas generated across units.	Number of high-quality ideas generated from outside the firm.	Percentage of all ideas generated that end up being selected and funded.	Percentage of funded ideas that lead to revenues; number of months to firs sale.	Percentage of penetration in desired markets, channels, customer groups. Number of months to full diffusion.

Figure 3.22: The Innovation Value Chain adapted from Hansen & Birkinshaw (2007)

Roper et al. (2008) developed another innovation value chain model, which had three phases focusing on knowledge production, transformation and exploitation (refer to Figure 18 below). The model was developed for manufacturing organisations emphasising the drivers for innovation, production and organisation growth. According to Sheu (2009), the "*model highlights the structure and complexity of the process of translating knowledge into business value and emphasizes the role of skills, capital investment and firms' other resources in the value creation process*".

The innovation value chain models of both Hansen & Birkinshaw (2007) and Roper *et al.* (2008), provide strong conceptual relations between the various stages of the innovation process but lack an implementation strategy. This is seen as becoming a strong norm under innovation models to neglect implementation and exploitation strategies.

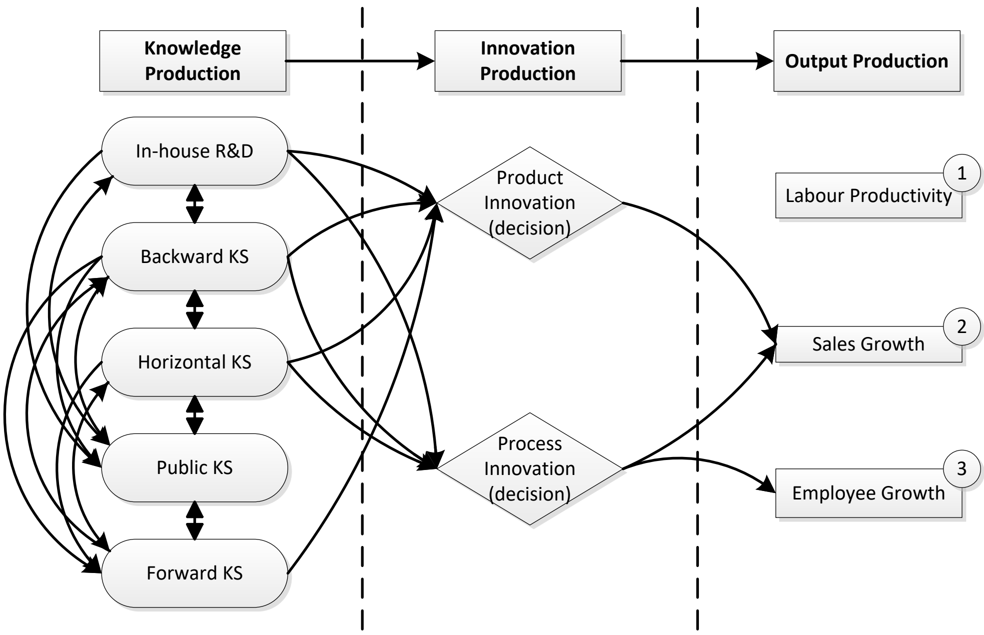


Figure 3.23: The Innovation Value Chain adapted from Roper *et al.* (2008)

All these fifth-generation models follow traditional business development processes, and the marketing of new products are all within an organisation's boundaries. This is known as closed innovation systems where the development of the ideas is kept in secrecy internally with minimal, if any, external input (refer to Figure 3.24). The majority of the innovation models discussed are based on a closed innovation system with minimum use of external sources for innovation.

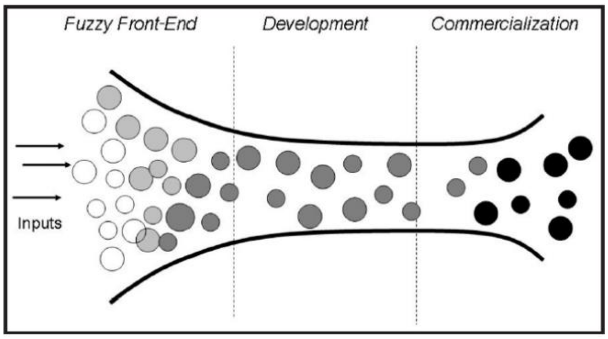


Figure 3.24: Closed Innovation Model adapted from Chesbrough (2003) and Du Preez & Louw (2008)

Chesbrough (2003) coined the newest generation of innovation models as open innovation models, where external sources are used for idea generation as well as channels to market, (refer to Figure 3.25 below). Buyse (2012) suggested that open innovation came from advanced strategic partnerships that came in the form of collaborative marketing and research arrangements providing additional value for products in the form of quality and other non-price factors. In an open innovation process, both internal and external resources are used in combination to develop new ideas and technologies through to the process of commercialising the newly developed products and technology. This brings forth various new benefits and drawbacks as the innovation environment has drastically changed through new possibilities brought by networking and collaboration.

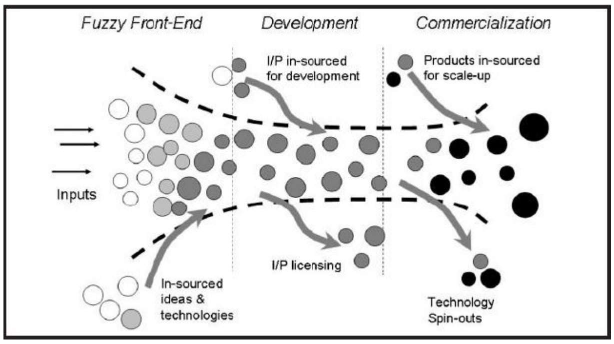


Figure 3.25: Open Innovation Model adapted from Chesbrough (2003) and Du Preez & Louw (2008)

The shift towards open innovation is becoming increasingly more important for companies as not all good ideas are necessarily developed within the company itself, and not all ideas should necessarily further develop ideas within the company's own boundaries. In Table 3.2, a comparison is given between closed and open innovation principles to give a better understanding of the differences between the two types of models. Key advantages of open innovation for companies are that there is a larger pool of ideas and technologies to drive internal growth and it can be used as a strategic tool to explore new growth opportunities at a lesser risk (Chesbrough, 2003).

Table 3.2: A Comparison between closed and open innovation models[62]

Closed Innovation Principles	Open Innovation Principles
Specialist and smart people in specific fields work for the organisation to develop innovation to sustain a competitive advantage.	Creating the most and best ideas in the industry and making the best use of the ideas to sustain a competitive advantage.
Profit from internal R&D requires the team to discover the innovation, develop it and take it to the market.	External R&D can create significant value while internal R&D is used to verify and value some significance.
The company focuses on discovering innovation first to take it to the market first. The company controls the intellectual property and know-how, so that competitors don't profit from the company's ideas.	Profit doesn't just come from discovering innovation; it comes from commercialising innovation. Buy and sell intellectual property to advance the company's business model.

With the continued growth in online communities and networks, the shift towards an open innovation concept has become more applicable as '*crowdsourcing'* and '*crowdfunding*', forums, etc. provide practical application tools. Additionally Du Preez and Louw (2008) argue that organisations can exploit the open innovation concept through developing integrated knowledge network components supporting the innovation landscape with the innovation knowledge value chain (also refer to Chapter 5).

3.3.4. FUGLE INNOVATION MODEL

Du Preez & Louw (2008) developed the Fugle model to address two major shortcomings they found in other innovation models with the aim to "*help businesses to identify, evaluate, develop, implement and exploit new products and services more efficiently and effectively*". These two major shortcomings are:

(1) Innovation models evaluated predominantly focus on identifying and selecting new ideas and concepts and partially or completely neglect the exploitation of the new innovation in different markets, business models and application areas (diffusion of innovation). The exploitation is more important as it is where the organisation can generate more revenue and value than the cost associated with R&D.

(2) Most innovation models also address product innovation as opposed to service innovation, which makes the models redundant for business-to-business organisations.

The aim of the Fugle model is to create business value which is illustrated in the cause and effect diagram on the next page (refer to Figure 3.26). The diagram reads from left to right with each block needing to be achieved before proceeding to the next block.

[62] Adapted from the sources Chesbrough (2003) and Sprijt, J., 2013. Open Innovation. [Online] Available at http://www.openinnovation.eu/tag/open-innovation/ [Accessed 27 October 2013].

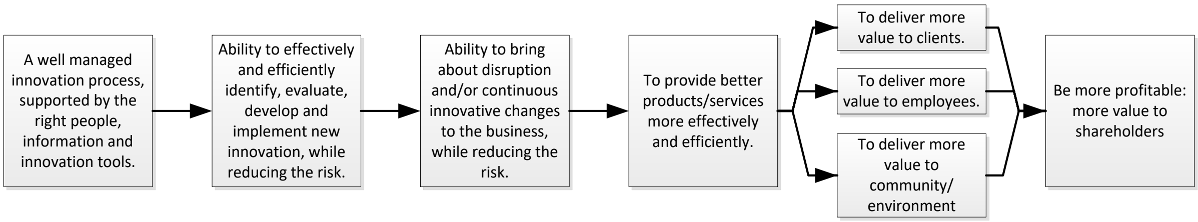


Figure 3.26: The Business Value of the Fugle Innovation Process Model adapted from Du Preez & Louw (2008)

The model is rooted in creating business value and combines two generic innovation processes as phases, which are illustrated in Figure 3.27 below:

(1) Convergent innovation front-end or funnels: This phase has three stages comprising of idea generation, concept definition and concept feasibility. The process starts by identifying and generating opportunities and ideas that are evaluated and captured to create a portfolio of projects.

(2) Divergent innovation back-end or commercialising: This phase also has three stages that consist of deployment, refinement and exploitation. The process starts by formalising the solution, then further exploits it through developing new business models and markets.

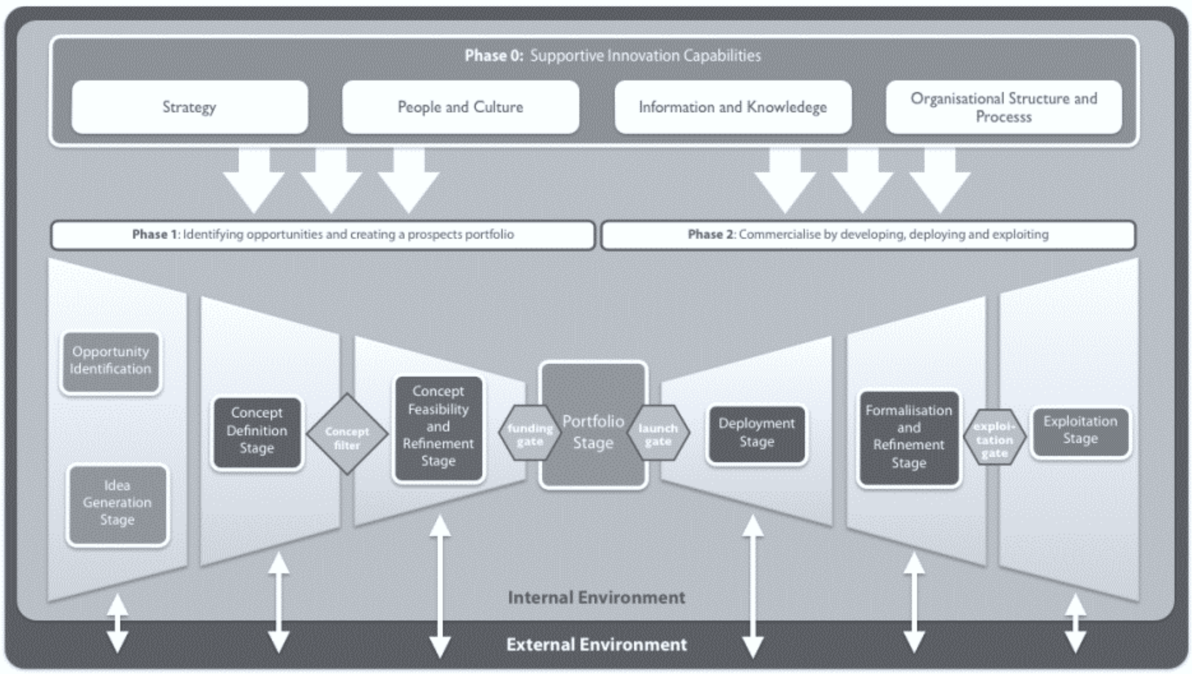


Figure 3.27: The Fugle Innovation Process by Du Preez & Louw (2008) adopted from Marais (2010)

This model uses a stage-gate innovation process with various gates between stages to manage the process more concisely and even though the process looks linear, iterative loops and overlaps between steps are worked in at various stages, as well as the impact from both internal and external environment being considered. The steps also run parallel to one another for example idea generation and idea capturing, while the portfolio and information management activities occur throughout the process. Additionally, business aspects such as strategy, human resources, information and knowledge systems, and organisation structure and process are assigned to the respective phases.

3.3.5. INNOVATION LIFE CYCLES AND CAPABILITY MATURITY MODEL

In Chapter 2, the concept of technology life cycles and business development was discussed, specifically relating to the '*valley of death*'. When considering the difference between invention and innovation, life cycles can address the different activities that must be completed fundamentally. This entails activities such as the consideration and utilisation of specific inputs and information, the creation of definite outputs, and successful commercialisation that creates value. Therefore, innovation life cycles are essentially the necessary process activities for execution and implementation.

This is where innovation management plays its vital role in the innovation life cycles and to illustrate this, the life cycles will be represented in phases as shown in Figure 3.28 below. This generic innovation life cycle applies a basic systems engineering approach as execution is achieved through essential inputs being considered and utilised; activities performed and the outputs generated (Du Preez, *et al.*, 2013). The phases of the generic innovation life cycles include the following:

- ***Invention:*** This entails the identified opportunities, generated ideas and generally relates to creativity, whereby the ideas generated could relate to products, processes and/or business concept.
- **Feasibility:** This entails the feasibility of the generated ideas that is determined through testing, screening and customer validation. This phase also includes the execution of the designs, functionality analysis and specifications.
- **Implementation:** Addresses the advance and detailed designs as well as the creation and implementation thereof.
- **Operation:** Is the commercialisation process whereby a viable output is produced. This includes activities such as production, quality control, process optimisation and deployment strategies.
- **Disposal:** Is the reflection and learning closure from this particular process initiative, but is not the conclusion of the innovation process (also sometimes referred to as *diffusion*).

Unlike a basic linear model, each of these phases can be revisited and repeated for continuous development and improvement upon the original initiative. This ties in closely with knowledge management and the learning process of an organisation (refer to Chapter 5) to sustain its competitive advantage.

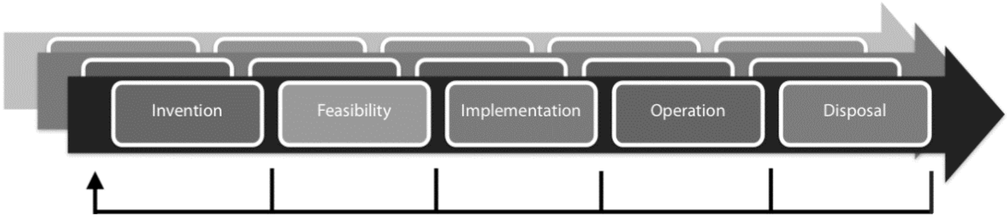


Figure 3.28: Generic Innovation Life Cycle[63] adopted from Du Preez *et al.* (2013) and Essmann (2009)

The innovation capacity maturity model (ICMM) by Essmann (2009) was developed from extensive evaluation of maturity models, and has three main areas of capability requirements, namely, life cycle execution, knowledge exploitation and organisational efficiency[64]. The ICMM purpose is clustering best innovation capability practices that are in a systematic process (refer to Figure 3.29 below) aimed at describing the process of improving the innovation capability of the organisation. It also builds on the basis formed by innovation life cycles processes and utilises an enterprise engineering fundamentals.

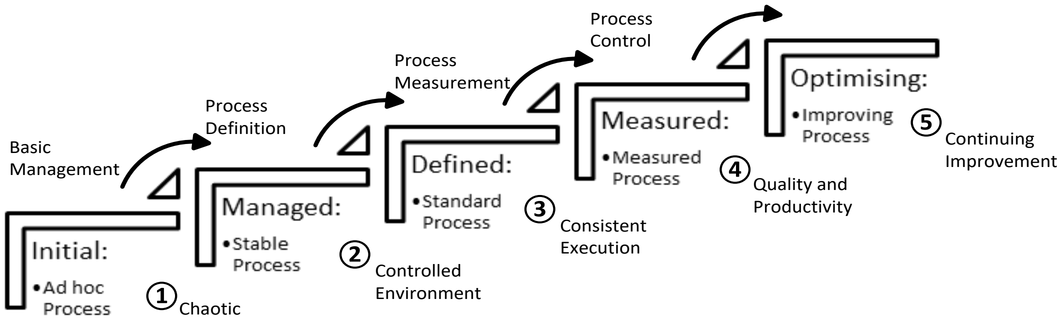


Figure 3.29: Generic Maturity Levelling Structure based on Champlin (2003) adopted from Essmann (2009)

The ICMM was then taken further in forming an innovation project landscape whereby the organisation strives towards improving the speed of innovative products going to market to achieve and sustain a competitive advantage (Schutte, 2010). This model is constructed through the combination of the Fugle innovation process (Du Preez & Louw, 2008) and the innovation capability maturity process (Essmann, 2009). This innovation project process is illustrated in Figure 3.30 below and consists of the following components:

- ***Timing:*** A dimension of time horizontally on the top illustrates the enterprise's striving towards a competitive advantage.
- ***Status:*** A certain innovation purpose/focus and operational modes are required, depending on the enterprise status, to achieve its competitive advantage.
- ***Execution:*** The execution ability of innovation projects by the enterprise is illustrated by the Fugle innovation process (Du Preez & Louw, 2008) and is essential to achieving the enterprise's competitive advantage.

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[63] *It is similar to the Product Life Cycle, the Enterprise Life Cycle and the Technology Life Cycle. It is also discussed in more detail in the research by Essmann (2009, p.51-64).*
[64] *Essmann (2009, p. 32-50 & 95).*

- ***Capability:*** The innovation process for execution consists of two constructs, namely, the innovation capability construct and the organisational construct (Essmann, 2009).
  - The innovation capability construct consists of an organisational support, knowledge and competency, and innovation process.
  - The organisational construct consists of strategy and objectives, function(s) and processes, organisation and management, data and information, and customers and suppliers.
- ***Focus & Modes:*** The enterprise innovation focus and operational modes of the ICMM whereby the enterprise continuously optimises and improves on innovations during operations, and aims to disruptively innovate over time to sustain a competitive advantage (Essmann, 2009).

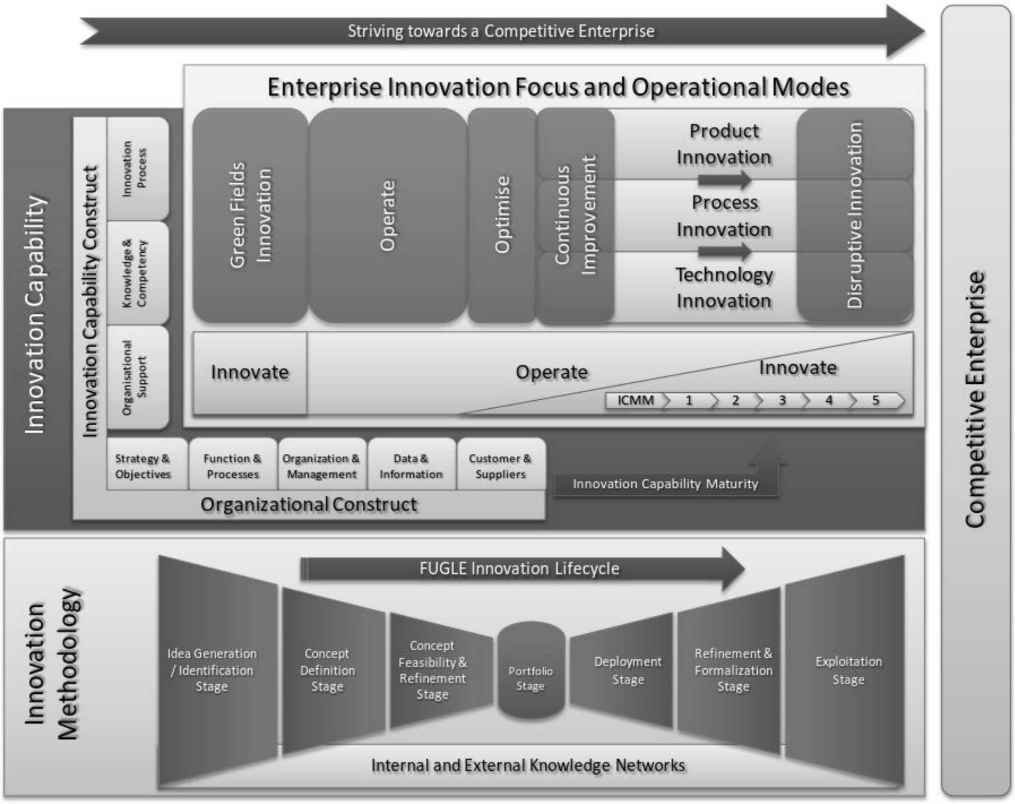

Figure 3.30: Innovation Project Process based on Essmann (2009) and Du Preez & Louw (2008) work, adapted from Schutte (2010)

3.3.6. EVOLUTION OF THE INNOVATION MODELS

In Figure 3.31 below, a summary of the historical evolution of innovation models is illustrated and it is evident that the innovation environment is ever-evolving from simple linear models to more complex integrated network models through to collaboration, networking, open innovation and extended innovation network models.

The new paradigm established by each generation calls for a new logic and pragmatic implementation aspects. Godin (2013) concluded that throughout history "*models shape how innovation is understood and, as a consequence, what policies are formulated and implemented*". The concept of open innovation and the network paradigm makes it possible to exploit a combination of innovation processes and find new ways of organisational collaboration whilst competing concomitantly.

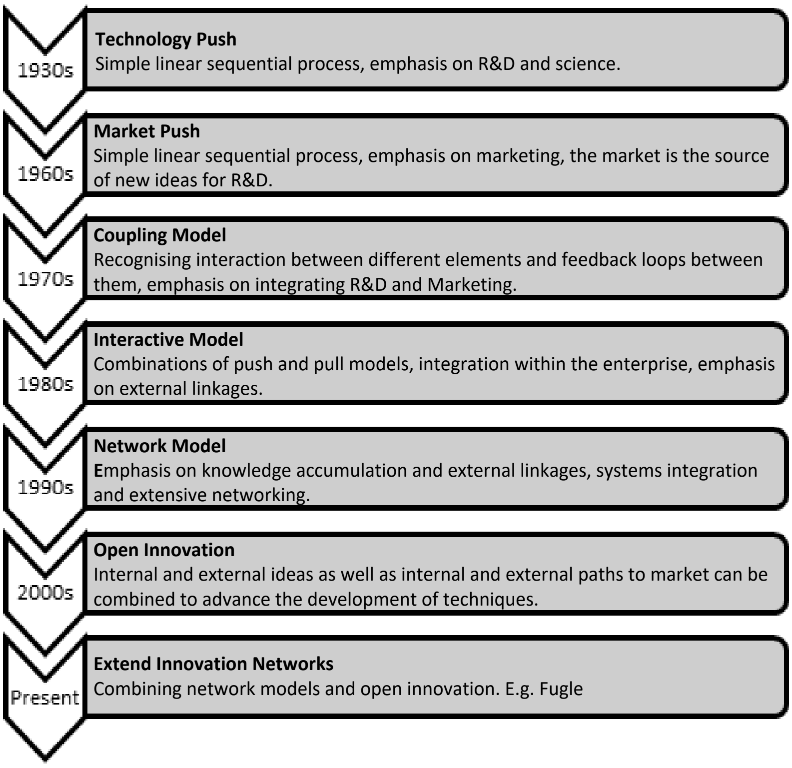

Figure 3.31: Historical Evolution of Innovation Models adopted from Marais (2010) and Du Preez *et al*. (2013)

An inclusive summary of various prominent innovation models can be found in the research of Van Zyl (2006), Van Zyl *et al.* (2007) and Du Preez *et al.* (2013), and is illustrated in Figure 3.32 categorised according to innovation type and innovation process phase. While various other innovation models were discussed in this chapter, the summary gives a good overview of the various innovation models. It can clearly be seen that only a few models incorporate both product innovation and enterprise engineering, with the Fugle Model and Systems Engineering approach being the most prominent. For any model to be considered for the commercialisation process, it requires both product innovation and enterprise engineering capabilities. For the purpose of this research study, the Fugle Model will be regarded as the best practice model while aspects of systems engineering will also be considered.

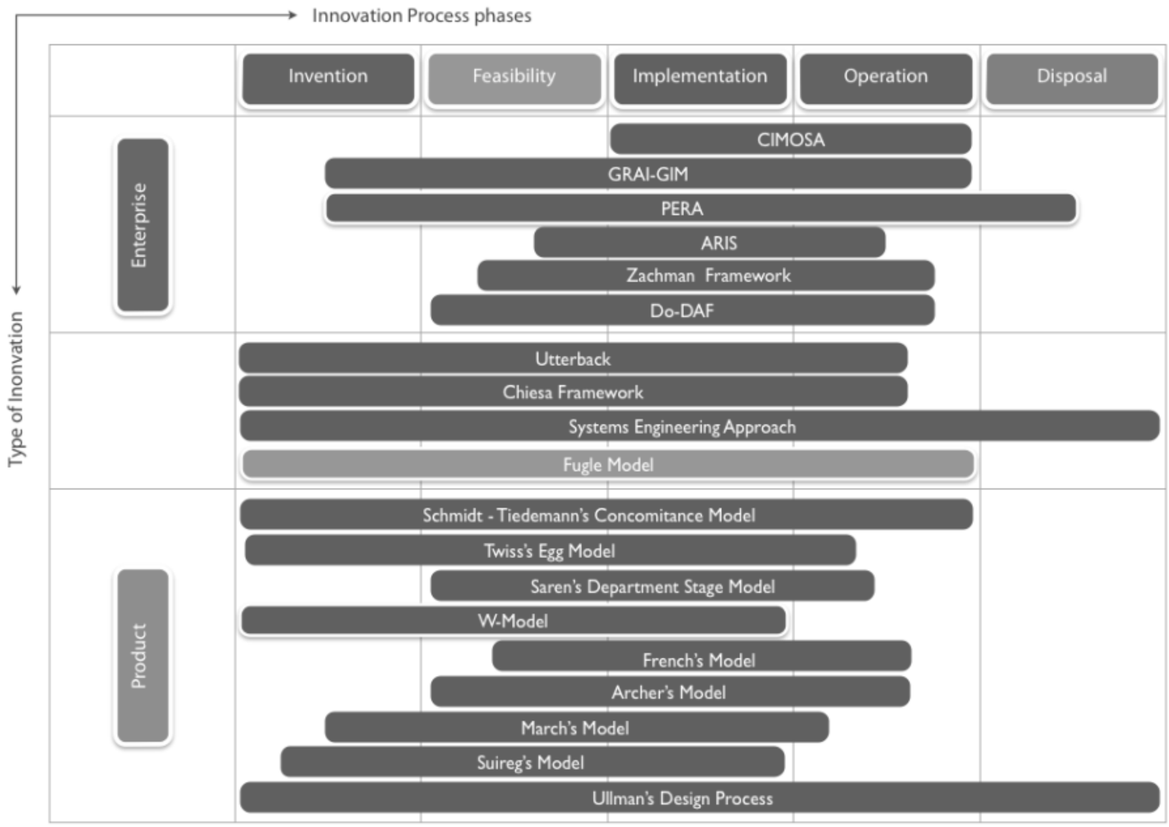

Figure 3.32: A Summary of Various Prominent Innovation Models According to the Type of Innovation and Innovation Process Phase adopted from Marais (2010) and Du Preez *et al*. (2013)

3.4. INNOVATION MODELS SUMMARY

The previous section of literature on a selection of innovation models all have their own benefits and drawbacks, and since there is an abundance of variables impacting innovation and design process, no model can inclusively cover all the different views on application areas. A summary of the literature review of innovation process models suggests the following aspects will be required to take into consideration as beneficial design criteria to the Framework (Du Preez & Louw, 2008):

- Innovation requires either a technology push or market pull or a combination, but generally, a combination of the push and pull is essential to the success of an innovation process.
- The innovation model generally has the following steps and/or stages in its process:
    - Opportunity identification and idea generation;
    - Concept development;
    - Concept evaluation and selection;
    - Production development and implementation;
    - Commercialisation and diffusion.
- Modern innovation models integrate different components and functions that run concomitantly.
- The open innovation allows a network approach the driving of innovation from both internal and external environments.

- The Fugle Innovation model provides the best solution and balance between invention and commercialisation from the models evaluated. Hence, it can be regarded as the best practice innovation model found in the literature.

The design criteria that could be detrimental to the Framework that comes from literature on innovation models are as follows (Du Preez & Louw, 2008):

- The host of innovation models currently in the literature is more geared towards large organisations, neglecting the dynamics of entrepreneurship and start-ups from which the innovation model must fundamentally be based on. Principles such as entrepreneurship, business model innovation[65] and lean start-up[66] principles, to name a few should be taken into consideration. In addition, few models align development directly to strategic management of the organisation, which only promotes incremental innovation[67], but this can limit disruptive innovation[68].
- Innovation process models neglect partially and some completely, the commercialisation aspect of innovation. Exploitation of new innovations in the market is an essential enabler of financial survival and for sustaining a competitive advantage.
- Innovation models also tend to align development directly to strategic management of the organisation, which promotes incremental innovation, but can prohibit disruptive innovation in the process. This at times has shown to be the downfall of even large organisations such as Kodak.
- Innovation models also do not necessary take into account the practical structuring of an organisation as a fundamental design principle, which inhibits potential legal benefits that can enable the development. However, some models theoretically consider project teams that can inherently implement various project management structures.
- Most of the innovation process models incorporate some of the form of "*innovation gate-keepers*" which allows the innovation council to reject ideas without ever testing the idea in the market.
- Incentive structures and organisations' culture to innovate are two important aspects, which in the case of a closed innovation system become crucial for sustaining an innovative organisation and are mostly neglected in the models discussed.

3.5. VENTURE CAPITALISTS AND VENTURE CAPITAL MODELS

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[65] The leading authors Osterwalder & Pigneur (2010) of the *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers* book on business model innovation.

[66] The author Eric Ries (2011) coined the term lean start-up in his book called *The Lean Start-Up: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*, and made a Harvard Business School (HBS) publication called *Hypothesis-Driven Entrepreneurship: The Lean Start-up,* also cited by Steve Blank in the HBS article, *Why the Lean Start-up changes everything*.

[67] Definition of Incremental Innovation according to Business Dictionary: "*A series of small improvements to an existing product or product line that usually helps maintain or improve its competitive position over time…*" [Online] Available at http://www.businessdictionary.com/definition/incremental-innovation.html#ixzz2kHnOQsYP [Accessed 28 October 2013].

[68] Definition of Disruptive Innovation according to Business Dictionary: "*The process of developing new products or services to replace existing technologies and gain a competitive advantage...*" [Online] Available at http://www.businessdictionary.com/definition/disruptive-innovation.html [Accessed 28 October 2013].

In this section, venture capitalists and venture capital models will be discussed in detail. Here venture capitalists are regarded as the fund managers implementing the process of the venture capital model while the venture capital model consists of the organisational structure.

3.5.1. DEFINING VENTURE CAPITAL

As defined in Chapter 2, venture capital (VC) is an independent organisation or company that provides valuable capital to entrepreneurial start-ups (ventures) which potential can achieve high growth and radical global scaling (Van Zyl, et al., 2013). The capital will be in exchange for equity in the start-up and is expecting high rates of returns. The reason for the ownership exchange is the element of high risk that is involved, but high risks means high rewards, which drives the appetite of the investor (Herrington, et al., 2009).

Investors (also known as limited partners), invest their funds into the VC fund which is then managed and run by the venture capitalists (also known as general partners). The venture capitalists manage the sourcing of entrepreneurial start-ups through to providing additional support to the entrepreneurial start-ups invested in. Their role is essential to manage the investment and help mitigate risks of the start-up to ensure a return of investment.

3.5.2. THE IMPORTANCE OF VENTURE CAPITAL

In the literature, there is a big debate on whether venture capital actually creates wealth and whether venture capitalists are successful in their investments. However, they are regarded as critical[69] to the innovation and start-up ecosystem providing improved market and business sophistication.

There is also a direct correlation between strong established start-up ecosystems and respective economic position giving them a global advantage (e.g. Silicon Valley, Tel Aviv, Switzerland) (Marmer *et al.,* 2012). In general, having a strong VC market provides additional advantages to the economy from a macroeconomic perspective, such as (Su, 2011):

- *Creating employment opportunities as successful entrepreneurial businesses are supported and grow.*
- *Creating and maintain a talent pool for local and international professionals to work within the country.*
- *Creating competition as industries become more competitive with an increasing number of businesses that improves the overall economic position.*
- *Creating a positive cashflow and allows for repeated money cycles within a region and country.*
- *Creating potential revenue streams for universities and governments through the commercialisation of their intellectual property.*
- *Creating a positive psychological impact as dreams, opportunities and ideas are given the platform to be commercialised and create a lasting impact in society.*

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[69] Key components in both the Global Innovation Index (2013) report by Cornell University, INSEAD and WIPOas well as in the Start-up Genome (2013) report by Herrmann, *et al*.

Gompers and Lerner (2001)[70] argue from a microeconomic perspective that "*VC [businesses] realize that they make money by identifying promising innovations early, investing capital to build the venture, and aiding the entrepreneur with his or her business*". In an article by Skok (2010), he highlights five main characteristics why start-up businesses fail, namely, market problems, business model problems, poor team management, cashflow problems and product or service problems. These core characteristics in essence enable start-up businesses to grow and scale to become more sustainable. The importance behind scaling is that it must be properly balanced for growth in all five-core business dimensions being the customers/market, product/services, team, business model, and funding. Additionally, Van Zyl et al. (2013) argue that the dominant reason why start-up businesses fail is that there is disproportionate scaling of one or more of the core business dimensions.

A synthesis of challenges associated with entrepreneurship and start-ups will be discussed in more detail in Chapter 4, but for the purpose of this section, refer to Figure 3.33 below, where the start-up business life cycle curve is illustrated. In the start-ups life cycle, there are various challenges. Additional to the challenges listed above, there are other challenges that entrepreneurs need to overcome to be successful:

- Small number of team members;
- Limited resources;
- Competitive environment;
- Lack of extensive networks;
- Bootstrapped infrastructure;
- Focused on product, not on customer;
- Technical minds, but limited business skills;
- Lack of mentorship;
- Lack of support services;
- Short time frame to make it work;
- Lack of access to funding;
- Funded by the three F's (friends, family and fools);
- Extensive 'red tape' business environment.

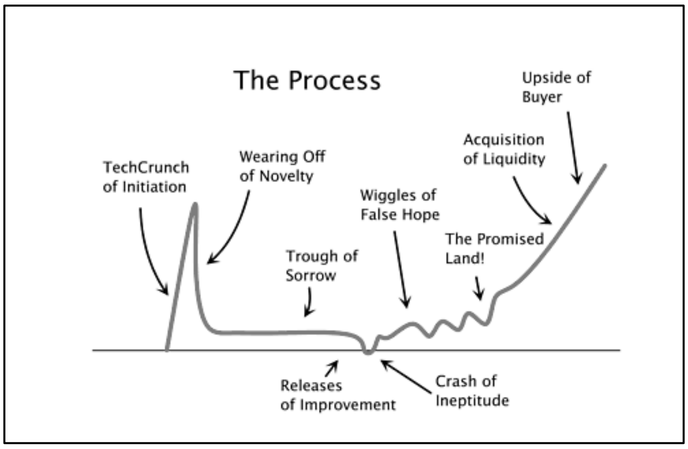


Figure 3.33: A Start-up Business Curve adopted from Paul Graham[71]

[70] *Gompers and Lerner (2001) argue that venture capital companies are successful in creating wealth despite the ongoing debate regarding their lack of wealth creation in literature.*

[71] Designed by Paul Graham, co-founder of Y Combinator seed capital firm, originally known as the Trough of Sorrow ("The Start-up Curve" or "The Process") as cited in the article by Jacob Aldridge (2011), From Paul Grahams trough of sorrow to infinity and beyond [Online] Available at: http://www.shirlawscoaching.co.uk/shirlawsresources/2011/8/25/from-paul-grahams-trough-of-sorrow-to-infinity-and-beyond.html [Accessed 25 October 2013]

In order to overcome these challenges, entrepreneurs specifically seek out VCs to assist as venture capitalists have not only access to funding, but can provide mentorship, access to networks, provide additional business expertise, etc. (Van Zyl, et al., 2013). In the end, once the venture capitalist has invested into the start-up, they are also seeking success as their funding is at risk. Both parties can clearly benefit from each other, as well as local economic growth.

3.5.3. TYPICAL VENTURE CAPITAL MODEL

Each VC model employs unique techniques to manage risk and nurture success as venture capitalists evaluate investment opportunities differently, but there are generic themes. These generic themes are what venture capitalists seek in start-up companies as the following aspects (Van Zyl, *et al.*, 2013):

- The 'Jockey':
  - What is the entrepreneur's ability?
  - What is needed to be successful?
- The management team:
  - Credibility of the team?
  - What is needed to be successful?
- Unique value proposition: What problem are you solving that people are willing to pay for?
- Competitive landscape:
  - The theories of 800 gorillas and blue/red ocean strategy?
  - Partnership opportunities?
- Business model:
  - What is the go to market approach/strategy?
  - What are the unit economics and finances of the business?
  - Are there recurring and multiple revenue streams?
- Exit strategy:
  - What is the exit strategy of the start-up company? IPO vs. M&A?
- IP Protection Strategy

A typical VC model would allow innovative ways to search externally for new ideas, would incorporate executive teams that can take ideas to market, and would develop innovative business models specifically for a targeted market. A straightforward example behind the investment finances of a VC model is to invest $10 million and expect after 5 years a $50 million in return as an exit. Venture capitalists can be seen as entrepreneurs of entrepreneurs with a special relationship established between the VC and entrepreneur. This relationship is seen as a marriage with a planned divorce, which is to resemble the exit. In Figure 29 below, a typical VC model and organisational structure are illustrated and the following stakeholders are explained:

(1) Limited Partners (LPs): Typically pension funds, endowments, and high net worth investors, seeking a high return on investment using metrics such as Internal Rate of Return (IRR) and Cash on Cash Returns (CoC).

(2) General Partners (GPs): Partners who are entrusted to invest LP's capital and to return capital at a future point in time. Manage investment pool called Fund I, Fund II and Fund III etc.

(3) Portfolio of Companies/Businesses: The GPs invest capital in entrepreneurs and their unlisted high growth potential start-up businesses.

Some key important aspects to understand regarding the typical VC organisational structure is that it protects both its investors and its portfolio companies. It manages the investors' investment and promises high rates of return, whereby the investor allows his or her *'money to work for itself'* while the venture capitalist consistently provides professional and trustworthy services to the investor. At the same time, the venture capitalist provides professional and secured investments to the entrepreneur. Other sources of funding could also include tax levies that the government provides in support of entrepreneurship, as well as other financial and resource support from the government in support of economic development.

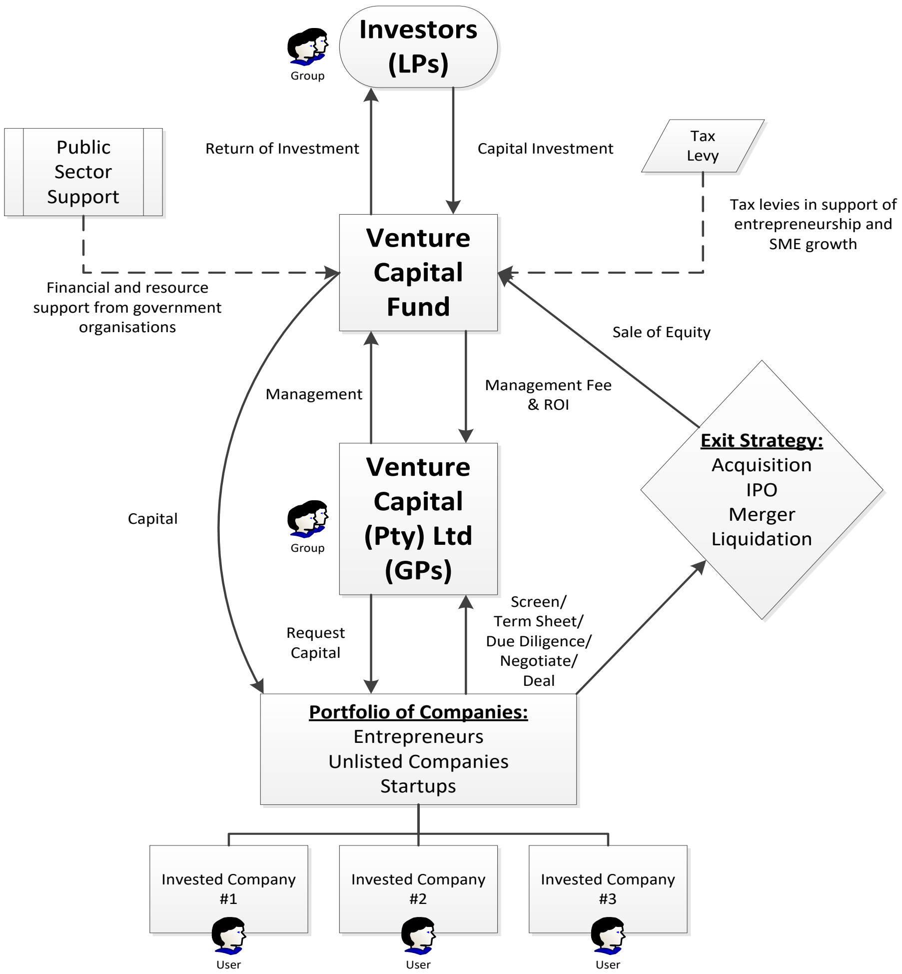


Figure 3.34: Venture Capital Organisational Structure

3.5.4. VENTURE CAPITAL PROCESSES AND EXIT STRATEGIES

3.5.4.1. THE VENTURE CAPITAL PROCESS

The generic venture capital flow diagram illustrated in Figure 31 shows the typical flow of capital investment between organisational entities and the managing personal. It also illustrates the main role of the stakeholders, as well as the role of the entities involved. The generic process of venture capital is simplistically summarised as venture capitalists, or a group of investors establishes an investment fund, which is managed by the venture capitalists. This investment fund uses annual fees to run the fund and establish a portfolio of high growth potential start-up businesses, which receives a capital investment in return for equity[72] of the start-up business. The start-up businesses are then scaled with the investment and expertise support from the VCs to exit (refer below to Why Exit Strategies for more detail), whereby the capital gains from the exit are distributed as pre-agreed percentages to the relevant stakeholders. The VC fund is expected to gain capital returns on multiple exits and mitigates the risk of failure through the portfolio effect, and funds usually exist for roughly seven to ten years.

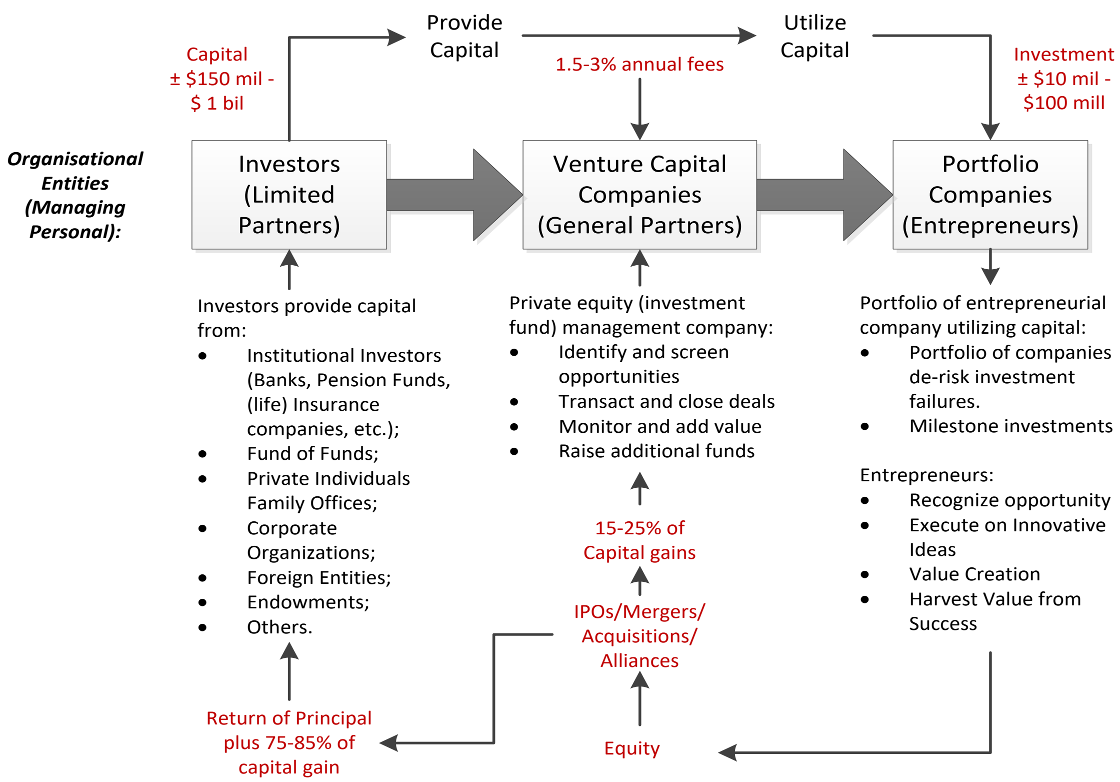


Figure 3.35: Generic Venture Capital Model Flow Diagram

The VC model's general process is illustrated in Figure 3.36 below. There are various aspects within which VCs look at the start-up businesses, but one of the important aspects is traction. Traction can be seen as the field data, pilot testing and/or signed customers that reduce risks for all aspects of the start-up business, making it a

[72] *Notably, VCs will generally take up preferred shares in start-up businesses instead of ordinary shares which provides some form of protection when the start-up business liquidates or exits under expected value. This means that VCs will have liquidation preference to business finances and assets to the value of predetermined percentages as stated in investment clauses regarding premium shareholding which allows for a consistent or minimum return on investments, refer to Rule 3-5-7.*

more valued investment with 'evidence' backing its valuation claims. Van Zyl *et al.* (2013) describes the VC's process as four phases that includes:

- **Find:** Is the evaluation process whereby VCs identify investment opportunities and specifically high growth potential start-up businesses with already established traction.
- **Make:** After finding promising start-up businesses, a term sheet[73] is contractually agreed upon pending a successful due diligence before the deal is executed. Generally, this can take anything from 1 to 3 months and depending on the nature of a start-up business, it can take up to 6 months.
- **Grow:** The advantages of the due diligence are that it is an external assessment of the start-up business that can indicate potential risks and the business is valuated. A growth analysis assesses risks, develops a growth strategy for a start-up business, and is implemented by the entrepreneurs to create value in their company. This is also usually done in an accelerator programme offered by some VCs.
- **Realise:** This is the realisation and implementation of the growth strategy whereby a specific exit strategy was planned and utilised. Of key importance is the positioning and timing of the exit to gain most from the business valuation. Assistance will be provided by the VCs in the form of expertise, pitching, negotiation and execution of the exit strategy.

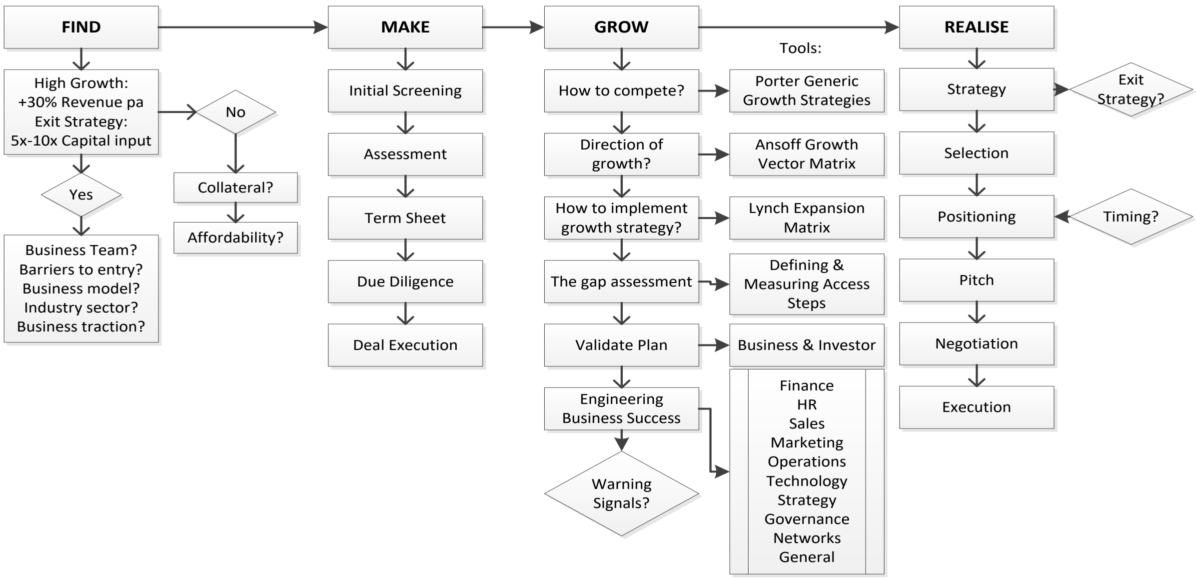


Figure 3.36: An overview of the Venture Capital Model's Process adapted from Van Zyl *et al.* (2013)

3.5.4.2. EXIT STRATEGIES

The exit of a start-up business is regarded as just as important as receiving investment to grow. Since investment, the start-up business is compelled to scale and grow as the value is created through the execution of the growth strategy. In essence, the value is created through the forming of a business, building of a business, and selling of

[73] Document outlining the material terms and conditions of a business agreement with four important issues, namely, the investment amount for percentage of shares, board composition and protective provisions (e.g. preferred shares), liquidation preference, and bad leavers.

the business. However, the key importance of the exit strategy is that more economic value can be created for the founders, investors and employees than in the entire process of actually building the business (Van Zyl, et al., 2013). This does not mean that the process of building a business should be overlooked; it should merely be aligned with the exit strategy.

So what is an exit strategy? An exit strategy for start-up businesses is defined as the process of leaving a present environment and situation through either achieving predetermined objectives or mitigating risks or failure (Hawkey, 2002; Phillips, 2006). The following possible exit strategies exist for private start-up businesses (Hawkey, 2002; Phillips, 2006; Van Zyl, et al., 2013; Mills, 2013):

- ***Succession of Family:*** Ownership transferred to family members, especially common in family-owned businesses.
- ***Management Buyout (MBO):*** Internal management and/or employees of the business buy out the business ownership.
- ***Management Buy-In (MBI):*** External management and/or employees to the business buy into the ownership of the business.
- ***Business Franchising:*** The business operations are optimised and franchise businesses are structured while an optional second stage can include franchiser buying out the ownership of the business.
- ***Business Mergers:*** Smaller businesses and/or sole traders in the same or similar industry merge to form a larger entity together and grow.
- ***Trade Sale:*** A third party buys or acquires the ownership of the business.
- ***Merger & Acquisitions (M&A's):*** An organisation, usually a large corporation, acquires the ownership of the business and merges it with its own.
- ***Initial Public Offer (IPO):*** A business develops a prospectus for a public listing and/or flotation on the stock exchange markets.
- ***Private Listing:*** A business develops a prospectus for a private listing by groups of wealthy investors.
- ***Liquidation:*** A business ceases trading and ultimately closes down whereby it goes into liquidation to sell off all business assets.
- **Bleeding/The Modified Nike Manoeuvre (*Just Take It*):** The cashflow of a business is bled dry on a daily basis by its owners or management.

In recent years, there has been a substantial change in the start-up ecosystems enabling more diverse exit strategies such as API's offshoring, cloud, EC2, open source and viral media, enabling start-up businesses to scale and grow affordably quicker (Van Zyl, et al., 2013). A great example of this change, is the lean start-up methodology created by Ries (2010)[74] which describes a process whereby rapid prototyping and customer-focused testing going through multiple pivots allows start-up businesses to scale quickly instead of gambling on a single business model and strategy (refer to Chapter 4). Another change is the fact that larger organisations

[74] Steve Blank describes why the new lean methodology for start-up businesses changes everything in the HBS article, *Why the Lean Start-up changes everything*.

are more and more using M&As to acquire new R&D as an ‘open innovation strategy, which benefits them in growth, innovation, removing competition and by buying growth stories, good marketing and branding (Van Zyl, et al., 2013).

So why is an exit strategy important? Most business owners have the majority of their wealth trapped in their privately-held business(es), the majority of their income and expenses are likely also tied to the business(es), and the business is dependent on the entrepreneur's continued efforts and commitment for continued growth success. A key aspect about entrepreneurs is that they are not necessarily managers, but rather like to create and grow new things (Van Zyl, et al., 2013). Hereby exit strategies assist entrepreneurs to:

- Continuously start, build and sell businesses or after selling the business to become an angel investor;
- Generally as the business grows and establishes, the focus turns towards optimisation and requires more process and management, which typically diminishes the founders’ value over time;
- Generally founders and entrepreneurs are known for creating and experimenting, not managing people, systems and large corporate structures.

Exit strategies provide the following reasons why investors would benefit from them (Hawkey, 2002; Van Zyl, et al., 2013):

- This provides the investors with an exit possibility at the end of their investing period;
- A consolidating industry provides good exit opportunities for exiting their investments;
- The business reached the growth limited without the support of a strategic partner;
- The peak performance of the business and/or market position improves the value of the business;
- The business will not attain financial sustainability making the option to the asset sale more viable than reinvesting into the business.

However, the exit strategy and options are not as simple as just a decision and plan to exit. Each exit strategy and options available is different and depends on the exit landscape, industry and situation. Other factors that influence the available opportunities to exit include (Hawkey, 2002; Mills, 2013; Van Zyl, et al., 2013):

- The reactiveness and awareness of the business of the exit landscape, industry and situation;
- An opportunistic approach to testing who would be interested in buying a business;
- The desperateness of wanting or needing to sell the business;
- The strength of the business market position and valuation;
- The extent of exiting, meaning full exit versus partial exit of business ownership and founders’ involvement;
- The business's long-term commitments, agreements and contracts;
- The business's long-term planned strategy and the execution thereof.

An exit strategy is not only convincingly beneficial to the founder/entrepreneur, but also for the investors. Each exit strategy will differ with the different environment, industry and situation the business is in, but notably the difference between making any other business decision and choosing the most viable exit option, is that for the first time, the decision for the business and what's best for the founders/shareholders are not necessarily the same thing (Van Zyl, et al., 2013).

3.5.4.3. VENTURE CAPITAL PRINCIPLES

There are two generic principles that venture capitalists and LPs use, namely, the "3-5-7"and "race to 100" rule which is a sort of back-of-the-envelope calculation on whether to invest or not. The "3-5-7" rule is simply just the consistency that a VC can return three-times CoC or more to the LPs as illustrated in Figure 3.37. The logic behind it is that risk and reward combined with the portfolio effect of companies will average the exited companies to above three-times CoC.

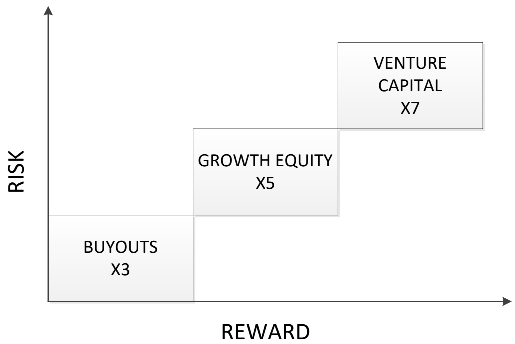


Figure 3.37: The 3-5-7 rule for Venture Capitalists and Limited partners

The "race to 100" rule is a hypothetical gauge based on the venture capitalist's experience and 'gut-feeling' on how difficult it would be and how long it would take for the entrepreneurial start-up company to generate a US$100 million in sales. Why would this be important? The reasoning is simple, as soon as a start-up company reaches such a milestone, the more attractive its 'traction' becomes to larger corporations as an acquisition target. It is also the right size to look at going Initial Public Offer (IPO)[75].

To summarise the VC model and process, venture capitalists mainly focus on the commercialisation of innovation part, rather than the idea generation and invention part of innovation. They use external sources such as the community of entrepreneurs needing funding to scale their start-up business for growth. Once entrepreneurs have received a term sheet from venture capitalists, a rigid due diligence is performed on the start-up business and entrepreneurial team to reduce the risk and identify growth shortages within the start-up business. The venture capitalist will then provide additional resources and networks to enable the growth process to realise the exit strategy.

3.5.5. VENTURE CAPITAL MODEL TYPES

[75] Article worth reading regarding entrepreneurs with a high growth-potential start-up business and venture capital investment that IPO, by Chabot, C., 2009. *How Long Does it Take to Build a Technology Empire?* [Online] Available at http://ipo-dashboards.com/wordpress/2009/08/how-long-does-it-take-to-build-a-technology-empire/ [Accessed 28 October 2013].

3.5.5.1. EVOLUTION OF VENTURE CAPITAL

In order to understand VC, a brief overview of the history and evolution of VCs is required. In the book by Rao & Scaruffi (2013), "*The History of Silicon Valley*", the history of VCs are discussed in extensive detail, but a brief summary overview will be given of the book.

It all started in 1930s, where VC funding was born with the realm of rich and affluent individuals and families that invested in private businesses. The most notable investors were the Vanderbilts, Whitneys, Rockefellers and Warburgs, to name a few. Some of their notable investments were the Rockfeller family investments in the Eastern Air Lines and Douglas Aircraft in 1938, while Whitney & Company invested in Pioneer Pictures in 1933, and Florida Foods Corporation, which sold Minute Maid to Coca Cola in 1960. These are all examples of early risk capital that later developed in what today is known as private equity and venture capital.

Risk capital only truly started booming in the 1960s when the era of computers and technology businesses such as DRAM, Intel, SRI, etc. become the next big thing. This continued until 1990 with other famous names such as Apple, Xerox etc. joined in, but fields other than microprocessors, computer kits, Ethernet (LAN) and internet industries started receiving VC funding (e.g. biotech, alternative music and spirituality). In the 1990s, VC investments then became brand orientated and focused with deals mainly involving the next big name. This finally evolved in the 2000s, after numerous failures, the internet boom and the press dumbing VCs as "*vulture capital*" whereby VCs started focusing on specific mandate-related investments.

Notably during this time, VC investment deals were relatively low, but with the decrease in costs relating to technology start-ups and maturing start-up business ecosystems, investment deals increased rapidly which led to the development of international VCs offering diverse portfolios. Other types also formed such as groups of super angels forming large VC funds, earlier stage micro VCs, accelerator programmes run by VCs and even online platforms combining various types together. This history and evolution of VCs is illustrated in Figure 3.38 below which shows conceptually how investments increased as costs of start-up businesses decreased.

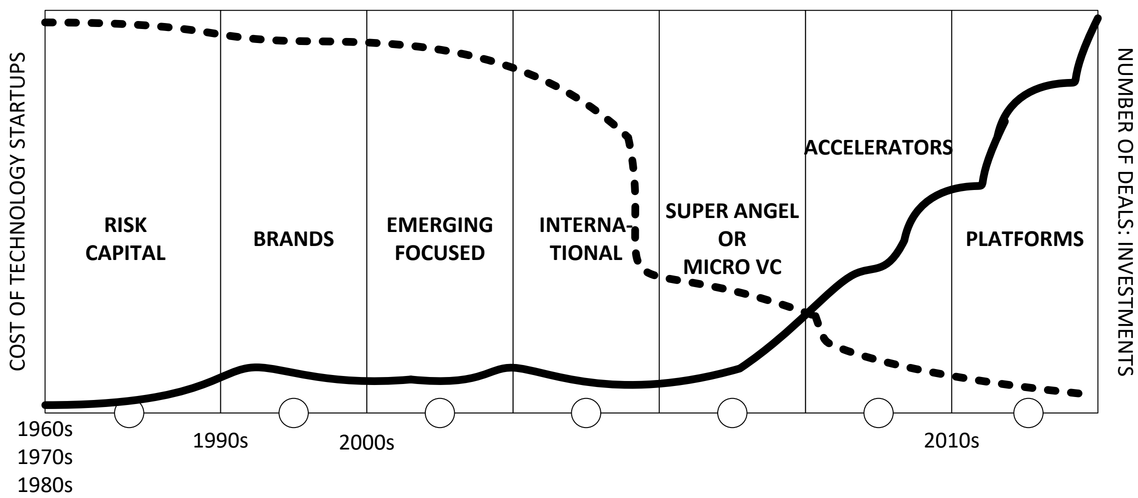


Figure 3.38: History and Evolution of Venture Capital Models adapted from Griffith (2013)

3.5.5.2. CORPORATE VENTURE CAPITAL

A key practical drawback of the innovation models reviewed was the lack of focus on commercialising the innovation and that models incorporate some form of "innovation gate-keepers" which allow an innovation council to reject ideas without allowing the innovation to be tested in the market. A possible solution is to remove "innovation gate-keepers" and to develop a Corporate Venture Capital[76] (CVC) model to focus on commercialising innovation through the process.

The reasoning behind the move towards a CVC model is because certain patterns have developed with "innovation gate-keepers" which prohibits the commercialisation process of taking ideas to market (Herger, 2012):

- Developers and innovators being unfamiliar with the proper process in the organisation.
- Innovative teams are missing the "entrepreneurial jockey" to take the innovation to the market.
- There being active or passive resistance at various "gate-keepers" along the innovation process.
- The organisation structures are not flexible in its realignment of its resources to allow the innovation process to go to market.
- The innovative team and the organisation suffer from a not-invented-here syndrome.
- The problem is with the innovation councils in the following ways:
    - Not necessarily having measurements in place such as innovation-to-successful-product ratio;
    - "Gate keepers" do not necessarily have funding;
    - The team lacks the expertise or "entrepreneurial jockey" to take the idea to market

In an article by Henry Chesbrough (2002), he discusses the history of CVC in the United States of America. He mentions that "*companies, at best, have mixed record funding start-ups*". He also developed and recommends a new framework that "*can help companies evaluate their existing and potential VC investments and determine when and how to use CVC as an instrument of strategic growth*".

3.5.6. VENTURE CAPITAL SUMMARY

VC models are a move in the right direction to give momentum especially in the long run towards developing an organisation to be an innovation-driven organisation. However, a VC model will not alone solve the problem of taking the idea to market as each business opportunity and innovation faces numerous barriers to entry and success. The VC model should further include:

- innovative productive processes;
- innovative culture and knowledge exchange;

[76] Definition of Corporate Venture Capital according to Business Dictionary: "*the practice where a large firm takes an equity stake in a small but innovative or specialist firm, to which it may also provide management and marketing expertise; the objective is to gain a specific competitive advantage*". [Online] Available at http://www.businessdictionary.com/definition/corporate-venturing.html [Accessed 28 October 2013].

- stakeholder communication;
- a culture of risk-taking and failing forward through celebration and encouragement;
- external partnerships, collaborations and Joint Ventures;

Key lessons from the innovation models are a strong focus on developing innovative products and services while the VC model lacks the strong innovation development process of such R&D and support structures enabling it. Most entrepreneurial businesses bootstrapped their start-up business with limited resources to eventually only receive funding from venture capitalists. However, innovation models can learn from the strong commercialisation focus that venture capitalists bring to executing the innovation process.

Venture capitalists, on the other hand, should also take note of the Fugle Innovation model, which from the models evaluated provides the best solution and balance between invention and commercialisation. It has a strong integrated knowledge network with a parallel process running and a strong business focus, but can be limited in the structural bureaucracy, "gate-keepers", funding and "entrepreneurial jockey".

3.6. CHAPTER SYNTHESIS

In this chapter, a literature review on innovation and venture capital models was done, with a particular focus on identifying best practices from the literature. The objective was to answer the set of SRQs that is defined in Table 1.1, and includes SRQ:3.1–3.15.

The SRQs answered in this literature review, as well as their outcome and significance, is synthesised in Table 3.3 below. The significance of the answered SRQs is used in Chapter 6 in the development of the conceptual framework, while the objective of this chapter (refer to Table 1.2) was successfully achieved as follows:

[SRO:3.0] ***Determine the best practices between innovation and venture capital models***.

The objective is achieved after answering the SRQ:3.1–3.7 helped determine the best practice in innovation models, while answering the SRQ:3.8–3.15 helped determine the best practice in venture capital models. These two domains were also compared to each other with regards to their benefits and drawbacks in supporting entrepreneurship and innovation.

Table 3.3: Synthesis of the Sub-research Questions and the Related Literature Review of Chapter 3

Ref. Code	Sub-research Questions	Related Section	Outcome Achieved	Significance
SRQ:3.1	What is the definition of innovation and innovative approaches?	§3.2.1.1	Yes	**FDC: 3.1** The enterprise innovation process fundamentally requires both a technological push and market pull.
SRQ:3.2	Why is innovation important?	§3.2	Yes	
SRQ:3.3	What is innovation management?	§3.2.1.3	Yes	**FDC: 3.3** The enterprise innovation process requires a good balance between inventing and commercialisation.
SRQ:3.4	What is the role of innovation models?	§3.3	Yes	

Ref. Code	Sub-research Questions	Related Section	Outcome Achieved	Significance
				FDC: 3.4 The enterprise innovation process requires to be designed for start-up businesses and dynamics of entrepreneurship, mitigating related risks.
SRQ:3.5	What are the different types of innovation process models?	§3.34	Yes	**FDC: 3.2** The enterprise innovation process requires the general processes to integrate components and functions. **FDC: 3.5** The enterprise innovation process must enable both incremental and disruptive innovation.
SRQ:3.6	What are the advantages and disadvantages of innovation models?	§3.4	Yes	**FDC: 3.6** The enterprise innovation process requires 'gate-keepers' to enable the innovation process while specifically looking at taking innovation to market.
SRQ:3.7	What are the best practices of innovation models?	§3.3.6 & §3.4	Yes	**FDC: 3.7** The enterprise innovation process requires to take into consideration the additional benefits provided by the type of organisation structure. **FDC: 3.8** Incentive structures and organisational culture need to be considered in the enterprise innovation process as well as the organisational structure fit.
SRQ:3.8	What is venture capital?	§3.5.1	Yes	**FDC: 5.3** In the organisational structure, the venture capital model's fund management and risk mitigation properties are required in the developing the framework.
SRQ:3.9	Why is venture capital important?	§3.5.2	Yes	
SRQ:3.10	What is the typical venture capital model?	§3.5.3	Yes	
SRQ:3.11	What type of venture capital models are there?	§3.5.5	Yes	
SRQ:3.12	What is the venture capital process?	§3.5.4.1	Yes	**FDC: 5.2** In the funding process of the venture capital model, an exit strategy is developed which is required for consideration in the enterprise innovation process of the framework.
SRQ:3.14	What is essential for a venture capitalist to invest into an entrepreneurial start-up business?	§3.5.4.2 & §3.5.4.3	Yes	**FDC: 5.1** The funding process of the venture capital model is required to be considered in the enterprise innovation process of the framework
SRQ:3.13	What are the advantages and disadvantages of venture capital model?	§3.5.6	Yes	**FDC: 5.4** Best practices in venture capital are to be used as considerations in developing the framework.
SRQ:3.15	What are the principles and best practices of venture capitals?	§3.5.5.1	Yes	

Ref. Code	Sub-research Questions	Related Section	Outcome Achieved	Significance
SRQ:3.16	*What are exit strategies and why is it important to venture capitalists?*	§3.5.4.2 & §3.5.4.3	Yes	

4 Start-up Business Strategy and Growth Models

This literature review focuses on entrepreneurs and start-up business. It includes an overview of the dynamics of start-up businesses and the respective strategies and growth models. The review evaluates the strategic growth models and defines best practice as tools and concepts required within the framework.

4.1. INTRODUCTION

The phenomenon of entrepreneurship and start-up businesses is nothing new, specifically the pivotal role it plays in developing the local economy, and has been discussed in numerous research studies. In today's modern world, start-up ecosystems have become a major role player in not only the local development of modern cities, but also in the innovation and economic output of countries (Her, 2013; Blank, 2014). Examples of this can be seen in Silicon Valley in the United States of America and Tel Aviv in Israel, to name but two (Herrmann, et al., 2013).

However, the failure rate of start-up businesses is high and so too are the associated levels of risk. So what are the dynamics surrounding start-up businesses? How can the environment be established to support and foster the growth of start-up business? The dynamics surrounding start-up businesses forms the core of this literature review, with the defined SRQs for this chapter being listed in Table 1.1 and including SRQ:4.1–4.13. The objective of this chapter is as follows (refer to Table 1.2):

> **[SRO:4.0]** ***Develop an understanding of the dynamics revolving entrepreneurial start-up businesses in terms of challenges, strategy and growth models.***

The focus of this chapter will remain on entrepreneurial start-up businesses as defined in Chapter 2, as well as related tools, theories and associated models. Strategy and growth models will also be focused on.

4.2. START-UP BUSINESS MANAGEMENT

4.2.1. ENTREPRENEURSHIP

The definition of entrepreneurship is a universal debate, with the French word '*entrepreneur'* originally dating back to the eighteenth century, with the evolved meaning of someone '*undertaking a venture*' (Dees, 1998) (refer to Table 4.2). In the research by Schumpeter in the mid-1900s, he conceived his "*Theory of Economic Development*" where the role of entrepreneurs was emphasised as pivotal to economic development (Ohyama, et al., 2009). He further coined the term 'Schumpeterian entrepreneurs'. It is defined as innovating entrepreneurs developing new products and processes, and using small businesses as an agent, to change industry and other simple lifestyle businesses, at times making present technologies and products obsolete (Wennekers & Thurik, 1999).

However, the role small businesses, start-ups and entrepreneurship play in economic development has evolved over time. During the twentieth century, small businesses were the vehicle driving entrepreneurship and creating a source of alternative employment and revenue (Thurik, et al., 2002). Today, start-up ecosystems are a major role player in developing modern cities and countries (Marmer *et al*., 2012; Blank, 2014). Start-up businesses, on the other hand, can be categorised as small businesses, but not all small businesses are start-up businesses.

According to a report by Herrington *et al*. (2009) start-up businesses can be differentiated by their growth potential and sources of financial support. The majority of small businesses can be seen as ***'lifestyle businesses'*** as less than 10% of small businesses are ***'entrepreneurial businesses'*** (Herrington, *et al*., 2009, p. 123). Stevenson and Gumpert (1991) explain this concept of "Entrepreneurial Firms" as a type of behaviour focusing on exploiting an opportunity with limited resources.

Over the years, its exact definition has evolved and to summarise this evolved definition and understanding of the ever-changing research field, refer to Table 4.2 below. However, regardless of the debate and definition, the phenomenon of entrepreneurship has been identified by its ability and vital importance to economic development through its potential to create employment and alleviate poverty (Herrington, et al., 2009; Herrington, et al., 2011).

In additional to the definition of entrepreneurship, different types of entrepreneurship have been identified such as survivalist, necessity, lifestyle, corporate/intrapreneurship, social, growth, 'tenderpreneurship', and 'pitcheneurship'. However, Blank (2010) argues that there are four distinct types of entrepreneurship or entrepreneurial organisations, namely, social, corporate, small business and scalable. They are defined and described as follows:

- **Social Entrepreneurship:** Was coined by Dees (1998) and can broadly be defined as the entrepreneurship involving social problems and needs that are addressed and solved through finding innovative solutions. Social entrepreneurs adopt a motive that is not driven by profit, but rather a motive to create and sustain social good and value. For more in-depth discussion on this topic, refer to the work by Dees (1998), Mair & Martí (2004) and Austin *et al.* (2006).
- **Corporate Entrepreneurship/Intrapreneurship:** Was coined by Lewis (1937) and can be defined as "*the process whereby an individual or a group of individuals, in association with an existing organization, create a new organization or instigate renewal or innovation within that organization*" (Sharma & Chrisman, 2007). For more in-depth discussion on this topic as well as corporate venturing, refer to the work by Sharma & Chrisman (2007).
- **Small Business or SME Entrepreneurship:** Can broadly be defined under the generic definition of entrepreneurship which "encompasses acts of organisational creation, renewal, or innovation that occur within or outside an existing organisation" (Sharma & Chrisman, 2007). Small business entrepreneurship is merely the limitations with regards to its resources and the success solely depends on the entrepreneur(s) themself. The entrepreneur's role would involve the development of its business model, acquiring the necessary resources and employees to deliver a service or product effectively to customers. The actual size of the business is small as defined and regulated by specific countries mainly for classification and tax reasons. For more in-depth discussion on this topic, refer to the work by Carland et al. (1984), Gartner (1988), Storey (1994), Wiklund & Shepherd (2005), Sharma & Chrisman (2007) and Aulet & Murray (2013).

- **Scalable Start-up Entrepreneurship:** Can broadly be defined as innovation-driven entrepreneurship that pursues global opportunities through development of a strategic competitive advantage by providing its customers with new innovations with regards to technical, market and/or business model domains (Aulet & Murray, 2013). This type of entrepreneurial start-up business possesses high growth potential and is scalable to become a large global organisation, but possesses a large degree of risk. This type of entrepreneurship was also discussed in Chapter 2.

The key differences between small business and scalable start-up entrepreneurship are listed in Table 4.1 below to emphasise the roles of innovation and its impact on the business. For the purpose of this research study, entrepreneurial start-up businesses with medium- to high- growth potential are chosen for the refined application in developing a conceptual framework.

Table 4.1: Comparison between Small Business and Scalable Start-up Entrepreneurship adapted from Aulet & Murray (2013)

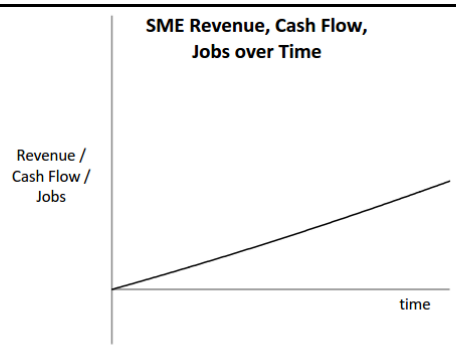
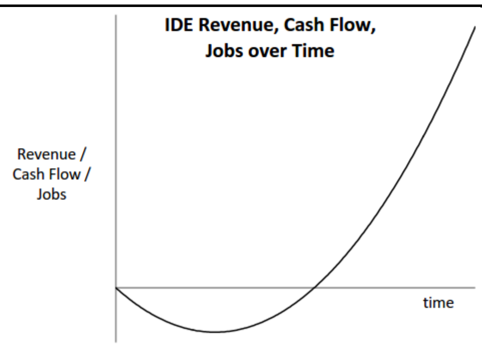
	Small Business or SME Entrepreneurship	Scalable Start-up Entrepreneurship
Business Focus	Typical focus of addressing the needs of local and regional markets only.	Typical focus of addressing the needs of global markets.
Role of Innovation	Innovation is more focused on efficiency and cost benefits, but not necessarily a necessity for establishment and growth, nor competitive advantage.	The business is rooted on an innovation formed by a combination of technical, process and business model aspects to develop potential competitive advantage for growth.
Employment	Employment typically locally sourced (e.g. restaurants or service industry) and usually, but not necessarily, provides relatively non-tradable employment opportunities (i.e. lower levels education and/or skills required).	Employment is not necessarily performed locally and provides more tradable employment opportunities, typically requiring higher levels of education and skill.
Ownership	Typically, family-owned businesses or limited external capital sources as shareholders.	Ownership base is typically more diverse and can include an array of external capital sources as shareholders.
Growth	The typical growth can be assumed, as linear and capital investments into the business system (revenue, cashflow, employment etc.) will relatively quickly behave in a positive manner.	The typical growth can be assumed as exponential and capital investments into the business system (revenue, cashflow, employment etc.) at first behave in a negative manner, until sustained success over time whereby it will behave in a positive manner.
Revenue, Cashflow, Employment, etc.		

Table 4.2: Summary of the Evolution of Contemporary Definitions and Understanding of Entrepreneurship adapted from Hitt et al. (2002)

Author	Definition and Understanding of Entrepreneurship
Richard Cantillon (1725)	*"An entrepreneur is a person who pays a certain price for a product to resell it at an uncertain price, thereby making decisions about obtaining and using the resources while consequently admitting the risk of enterprise."*
Jean-Baptiste Say (1803)	*"An entrepreneur shifts economic resources out of an area of low productivity into an area of higher productivity and greater yield."*
Schumpeter (1934)	*"Entrepreneurship is seen as new combinations, including the doing of new things that are already being done in a new way. New combinations include:* *1. introduction of new goods;* *2. new method of production;* *3. opening of new markets;* *4. new source of supply; and/or* *5. new organisations"*
McClleland (1961)	*"An entrepreneur is a person with a high need for achievement [N-Ach]. He is energetic and a moderate risk taker."*
Drucker (1964)	*"Entrepreneurs search for opportunities of change to exploit as innovation. Entrepreneurship is the act of innovation that involves endowing existing resources with new wealth capacity."*
Kilby (1971)	*"Emphasises the role of an imitator entrepreneur who does not innovate, but imitates technologies innovated by others. Are very important in developing economies."*
Kirzner (1973)	*"Entrepreneurship is the ability to perceive new opportunities. This recognition and seizing of the opportunity will tend to 'correct' the market and bring it back to equilibrium."*
Shapero (1975)	*"Entrepreneurs take initiative, accept risk of failure and have an internal locus of control."*
G Pinchot (1983)	*"Intrapreneur is an entrepreneur within an already established organization."*
Stevenson, Roberts & Grousbeck (1985)	*"Entrepreneurship is the pursuit of an opportunity without concern for current resources or capabilities."*
Rumelt (1987)	*"Entrepreneurship is the creation of new business: new business meaning that they do not exactly duplicate existing business but have some element of novelty."*
Low & MacMillan (1988)	*"Entrepreneurship is the creation of new enterprise."*
Gartner (1988)	*"Entrepreneurship is the creation of organisations: the process by which new organisations come into existence."*
Timmons (1997)	*"Entrepreneurship is a way of thinking, reasoning and acting that is an opportunity obsessed, holistic in approach, and leadership balanced."*
Venkataraman (1997)	*"Entrepreneurship research seeks to understand how opportunities to bring into existence future goods and services are discovered, created, and exploited, by whom and with what consequences."*
Morris (1998)	*"Entrepreneurship is the process through which individuals and teams create value by bringing together unique packages of resource inputs to exploit opportunities in the environment. It can occur in any organisational context and can result in a variety of possible outcomes, including new ventures, products, services, processes, markets, and technologies."*
Sharma & Chrisman (1999)	*"Entrepreneurship encompasses acts of organisational creation, renewal, or innovation that occur within or outside an existing organisation."*
Sir Richard Branson (2000s)	*"...entrepreneurs have been the driving force for growth in countries around the world. Their ability to see opportunities, to see order amongst chaos where others see only issues, problems and disorganisation, has helped transform communities and economies."*
Oxford Dictionary	*"...one who organises, manages and assumes the risk of a business enterprise."*

4.2.2. ENTREPRENEURIAL APPROACHES

The following entrepreneurial approaches to starting a new business venture and growing entrepreneurial start-up businesses are discussed in more detail, based on the research studies by Eisenmann *et al*. (2011) whereby four approaches will be discussed, namely, the vision-driven approach, the plan-driven approach, the improvisational-driven approach, and the hypothesis-driven approach.

4.2.2.1. VISION-DRIVEN APPROACH (“BUILD IT AND THEY WILL COME”)

The vision-driven approach or also known as the “*build it and they will come”* approach, can be seen throughout the world as a form of a technology push innovation model. This is where the entrepreneurs’ vision of a perfect product backed by some cursory research on the opportunity, is followed by a rigorous product development phase. In this, an engineering-dominated product development on the entrepreneurs’ vision is built without any initial business model hypothesis tests.

The entrepreneurs’ vision or “*build it and they will come”* approach is predominately from an ego-defensive pattern where the entrepreneur’s ego is heavily invested in the venture’s success. This provides various physiological comforts to avoid feedback and is stimulated by a fear of failure.

The inherent risks are that the business does not receive any initial feedback until product development completion and launch of the business. In other words, there is no initial 'traction', building on high uncertainty about demand and the probability of certainty regarding the market and whether the customer segment will accept the product.

4.2.2.2. PLAN-DRIVEN APPROACH (“WATERFALL" OR "STAGE-GATE PLANNING”)

The entrepreneur's vision is translated into a methodically executable business plan completed in sequential stages. According to Cooper (2001), the effort of the proceeding stages only commences after the completion of the preceding stage has successfully passed through the ‘gate’ of a formal review, hence “*stage-gate planning*” or graphically depicted as the “*waterfall planning*”. The stages typically include:

- **(1)** the concept exploration, culminating in a business plan that describes product features, target customers, technical challenges, competitors, financial projections and so on;
- **(2)** product specification, captured in a product requirements document that, at least in theory, provides sufficient guidance on proposed product functionality to allow engineers to begin design work;
- **(3)** product design;
- **(4)** product development;
- **(5)** internal testing;
- **(6)** alpha launch with pilot customers to validate technical performance.

Steps 3 to 6 represent the engineering team's plan included in stages, completed in parallel with other functions such as marketing.

This approach is usually more geared towards entrepreneurs introducing techniques from larger businesses to start-up businesses, where the technique is used to coordinate line extension efforts across separate organisation units. The downfalls are that after the concept exploration stage, the team typically will not receive feedback until it commences an alpha test. The work completed in big batches can leave errors introduced during early stage development requiring rework and due to the external environment rapidly changing can lead to outmoded assumptions preceding completion of all stages.

4.2.2.3. IMPROVISATIONAL-DRIVEN APPROACH ("JUST DO IT")

The dysfunctions of planning indulge the inclination towards entrepreneurial action or the improvisational approach. The founders jump into the start-up business process with imagination and aspirations, but without a strong product vision or a detailed plan. These founders rely on the ongoing feedback and assistance that they receive from people they know and meet, adapting their value proposition with the frequent input feedback from potential resource providers and customers, and respond to environment changes that they inevitably encounter.

The advantages are that it leverages scarce resources by tailoring an offering to suit the capabilities and preferences of the start-up business (Sarasvathy, 2009). The improvisation could steer a new start-up business, stepwise, toward opportunity. Without a strong vision, a clear plan, or hypotheses, however, it can be difficult to know when to make course corrections or what direction they should take. The decision rule guiding adaptations is vague: "*If outcomes seem to be improving, keep doing what you are doing, and consider taking a few more steps down this path; if outcomes are deteriorating, stop doing what you are doing and try a new path*". Nevertheless, what new path should the entrepreneur follow? Moreover, what is the performance threshold that dictates when to change direction, versus waiting for more input or simply trying harder?

With a lack of clear initial direction sense, searching incrementally for opportunity can pose a significant problem to the entrepreneur's failure to predict sequential reliance between decision outcomes. Examples of product design decisions that rely on early market feedback without overall strategy integration:

- After receiving positive feedback from early adopters, a start-up business may design its product to meet the needs of power users, only to discover later that its offering is *over-engineered* – too costly and too complex – for mainstream users whose support is essential to harness scale economies.
- After getting encouraging face-to-face feedback from target customers, a start-up business might launch a product that solves a serious problem for small businesses. However, if the entrepreneur does not anticipate that *direct customer contact will be required to explain the product's benefits*, and *the product will not yield enough gross margin to support direct sales*, then the entrepreneur may be surprised to discover that his business model is not viable.

4.2.2.4. HYPOTHESIS-DRIVEN APPROACH

In analysing the above-mentioned process, Eisenmann *et al.* (2011) found the following drawbacks with the different entrepreneurial approaches. The vision- and plan-driven approach provide strong initial direction sense, but lack feedback to change direction. The improvisational-driven approach embraces feedback, but lacks initial direction sense possibly inducing error due to sequential reliance between decisions.

The hypothesis-driven approach, also known as the "*lean start-up*" approach, is supported by research showing that start-up businesses that pivot once or twice are half as likely to scale prematurely, than start-up businesses that pivot more than twice or not at all. This is because one of the leading causes of failure for start-up businesses is premature scaling (Marmer, et al., 2012). Sequentially testing a comprehensive set of business model hypotheses ensures that pivots gather feedback from customers, induce the adaptations required and consider sequential reliance.

It is evident that the hypothesis-driven approach is more practical in application for starting a new business as the various assumptions of the business are tested. This approach will, therefore, be discussed in more detail as a methodology; process and strategy (refer to p. 7).

4.2.3. MANAGEMENT TEAM AND ENTREPRENEURS

In the field of building and growing scalable start-up businesses, entrepreneurs not only work with intellectual capital and innovation, but also strongly with assembling a management team that can turn an idea into reality. When venture capitalist investors seek investment opportunities, they look at numerous aspects as described in Chapter 3, but two specific aspects that are noteworthy are (Van Zyl, et al., 2013):

- *Who is the 'jockey' and managerial team?*
- *Do they have what is needed to succeed?*

During the past century, successful management practices have been developed for large organisations and have been extensively been discussed in the literature. However, the same cannot be said for start-up businesses and their entrepreneurship and innovation. This requires new thinking and the development of new successful management practices, instead of just relying on the vision of the great entrepreneurs we always read and hear about. The field of human management sciences is clearly related to entrepreneurship, but the focus of this section is merely to discuss the importance of management and to build an entrepreneurial team.

Ries (2011) states as a principle that "*entrepreneurship is a kind of management*" whereby he argues that start-up businesses are not products, but institutions that require management geared towards the context of high uncertainty. Kawasaki (2004) discusses the role of the team and recruitment in scalable start-up businesses to specifically relate to bootstrapped start-up businesses. He suggests the recruitment of '*unproven*' employees that are '*A players*' (team) and '*infected*'. The main reason for unproven employees is that they are inexperienced young people with heaps of raw talent and energy as compared to dream team proven employees, which is listed in Table 4.3 below.

Table 4.3: A Comparison between Proven and Unproven Employees adapted from Kawasaki (2004)

	Proven Employees	Unproven Employees
Remuneration	Salaries are high for respective experience, but you do not always receive the output justifying the high salaries.	Salaries are low for respective limited experience, and you usually receive at least output justifying salary payments.
Expectations	Top-of-the-line company expenses on employees w.r.t. equipment, environment, etc.	Satisfied with standard equipment required to complete the project/work.
Level of Energy	Ideally, focused and still high.	Ideally, controllable.
Knowledge	Employees are expected to have a high knowledge base while employees assume they know everything.	Employees are more willing to learn and are not expected to have the necessary high knowledge base.

The general skills required between large organisations and start-up businesses are another interesting comparison as to succeed in large organisations does not guarantee similar success in start-up businesses (Kawasaki, 2004). This comparison is listed in Table 4.4 below as the different skill sets required by the respective ventures. While this comparison is not exact science, but is slightly biased towards start-up businesses, it does provide a good conceptual framework from which to understand the differences. Lastly, '*infected'* employees are candidates that believe in the vision set by the start-up business and the enthusiasm to succeed against the odds.

Table 4.4: The Different Skills Sets Required for Large Organisations and Start-up Businesses, adopted from Kawasaki (2004)

Large Organisation Skills	Start-up Business Skills
Sucking up to the boss	Being the boss
Generating paper profits	Generating cashflow
Beating charges of monopoly	Establishing a beachhead
Evolving products and services	Creating products and services
Market research	Shipping
Squeezing the distribution channel	Establishing a distribution channel

4.2.4. START-UP BUSINESS GROWTH CHALLENGES

Entrepreneurs and their start-up businesses attempt to succeed under extreme uncertainty, but what are these factors contributing to this challenging environment? While this has been discussed in brief intervals throughout this research study[77], a brief synthesis of the main challenges will be discussed below.

[77] Challenges of TTOs to commercialise with spin-off companies in Chapter 2.

Foremost it is essential to understand the reasoning behind growth in the first place. Why should small businesses and scalable start-up businesses grow? As discussed earlier, not all small businesses are scalable start-up business, which is why most small businesses start small and remain small till eventual dying as growth is not the norm (Davidsson, et al., 2010). According to Aldrich (1999), Reynolds & White (1997) and Storey (1994), they significantly lack growth trajectory. The majority of these small businesses just serve local markets, but are imitative of more mature and larger business (Aldrich, 1999; Samuelsson, 2004; Amoros & Bosma, 2013).

In literature, there is a wide array of growth determinants that have been identified in research studies of small and start-up businesses. Davidsson *et al.* (2010), categorise growth determinants mainly into internal and external determinants, while also considering the effect of growth barriers.

4.2.4.1. INTERNAL DETERMINANTS

Storey (1994) and Davidsson *et al.* (2010) organised the range of different internal determinants into three main categories, namely, the entrepreneur(s) and manager(s), the business and the business strategy. These internal determinants were mainly compiled from research studies based on businesses in the United Kingdom conducted from the 1980s to the 1990s. Nonetheless, there is compelling enough research indicating that entrepreneurship is a global phenomenon and not just limited to specific business in a certain geographical region.

Storey (1994) found that research indicates *education, functional skills, management experience, motivation and number of founders* to have a positive growth impact on small and start-up businesses. However, Davidsson *et al.* (2010) argued only the following internal determinants of growth related to the entrepreneur(s) and manager(s):

(1) Founders' Motivation and Aspiration: Research has found that most founders have modest aspirations for growing their businesses (Cliff, 1998; Delmar & Davidsson, 1999; Clark, et al., 2001; Human & Matthews, 2004). In addition, compelling research has shown that there is a direct relationship between the owner-manager's motivation and growing their business and communicating the business vision and goals to its employees (Wiklund, 2001; Wiklund & Shepherd, 2003; Delmar & Wiklund, 2003; Baum & Lcoke, 2004).

(2) Experience and Education: Orser *et al.* (2000) found that business growth is a stimulus for subsequent business growth, as the entrepreneur personally learns of their abilities. Research by Box *et al.* (1993) found that abilities of the entrepreneur that positively affect business growth include years of entrepreneurial- and industry experience, and the number of previous start-up businesses, locus of control and scanning of both internal and external environment activities.

(3) Managerial Functional Skills: Small businesses have less access to resources, and knowledge and experience from external consultants, making the managerial capacity critical for the growth of the start-up business in present-day highly dynamic markets (Zahra & Filatotchev, 2004). The managerial capacity should include aspects such as scaling of operations (Daily, et al., 2002), accessing funding

(Pissarides, 1999), developing and cultivating networks (Lechner & Dowling, 2003), and allocating resources (Davidsson, et al., 2010).

(4) Entrepreneurial Team: The size of the team in start-up businesses has been found to positively impact the growth of the business (Delmar & Davidsson, 1999). The key components are the cohesion of the team (Ensley, et al., 2002) and that different team members complement each other's competence deficits (Cooper, et al., 1994), while joint working experience among team members has been found to increase speed of decision-making (Eisenhardt & Schoonhoven, 1990). The advantages of entrepreneurial teams[78] over 'lone-wolf' entrepreneurs are an increased experience and knowledge base, stress distribution, and business expense distribution risks are mitigated for investors.

Storey (1994) research found that structural characteristics such as age of the business, size and legal form all relate to the growth of the business. These three growth determinants relating to the business will be discussed in more detail below:

- **Business Age:** Stinchcombe (1965) argues that young small and/or start-up businesses are unable to compete effectively against larger businesses because of their "*liability of newness*" which is their lack of resources and networks rendering them at greater risk of failure. On the other hand, younger small and/or start-up businesses can be more entrepreneurial, rendering them more flexible and less rigid (Autio, et al., 2000; Sapienza, et al., 2006). However, Evans (1987) and Dunne & Hughes (1994) found in numerous empirical studies that the business age counts negatively to the growth of the business.
- **Business Size:** The sources of liability are a big debate between the business age and size (Davidsson, et al., 2010). However, the distinct 'liability of size' in terms of funding capital, number of employees and other resources as compared to large businesses, is a clear disadvantage in terms of survival for small and start-up businesses (Aldrich & Auster, 1986; Brüderl & Schüssler, 1990).
- **Business Legal Structure:** Different legal structures have different benefits and drawbacks, and differ from country to country. The most important aspect is that some legal structures are geared towards enabling growth while others are limited. A basic example is the difference between a sole proprietor and a corporation whereby a sole proprietorship only has one owner and corporations can have multiple shareholders.

When considering the growth determinants relating to business strategies, research evidence is far less conclusive (Davidsson, et al., 2010). Storey (1994) found a positive effect in growth for strategic variables including market positioning, technology complexity, and new product development and launching. The most evident reported finding is the strategic orientation of businesses, as well as the relationship between innovation and small business growth (Davidsson, et al., 2010).

[78] Callinan, A, 2014. Thinking of Going Solo? 7 Reasons You Need a Co-Founder. [Online] Available at http://www.entrepreneur.com/article/239945 [Accessed 20-September 2014].

4.2.4.2. EXTERNAL DETERMINANTS

In literature, the debate between whether internal or external determinants establish business growth is clearly evident. However, according to Davidsson *et al.* (2010) both internal and external determinants have an influence on the growth of the business. The external determinants that influence business growth can be summarised as the growth of the industry and the dynamics of the environment (‘*ecosystem*’) wherein the business operates. Both of these two external determinants have multiple factors influencing them, but due to lack of cohesion in literature, it is difficult to conclusively pinpoint what all those factors are.

The growth of an industry can for example be influenced by different industry-specific factors, each with a different meaning to the different businesses within that industry (Hawawini, et al., 2003). Kangasharju (2000) suggests four main components influencing small business growth within a specific industry that include the following:

- The market demand for the business products and/or services;
- The industry competitors and their actions;
- Manufacturing and production industry-specific factors;
- The local business environment features.

According to Dess & Beard (1984), the dynamics of the environment components can include aspects such as dynamism, heterogeneity, hostility and munificence. The industry dynamism creates an increasingly difficult environment for small and start-up businesses to survive in, but survivalists are rewarded in the prospect of growing (Davidsson, et al., 2010). There is difficulty in explaining cohesively the other environmental components as the research studies all differ because they are increasingly affected by specific contexts within the environment the business operates in.

4.2.4.3. GROWTH BARRIERS AND ENABLERS

Growth barriers are the opposites of the enablers and drivers of growth for small and start-up businesses (Davidsson, et al., 2010). The enablers and drivers of growth were discussed in Chapter 2 and can be seen as the measuring factors of a start-up and/or innovation ecosystem. For example, the Start-up Genome Report (2012) measures eight factors, namely, funding, performance, mindset, trendsetters, differentiators, support, talent and start-up output, while the Global Innovation Index (2013) investigates four main components namely, human and knowledge capital, legal framework, organisations and process, and funding.

It is clearly evident that this is a complex discussion with numerous factors while Davidsson *et al.* (2010) contend that the specific growth barriers for different businesses vary per industry, space and time. For example, Orser *et al.* (2000) argues that access to funding for high-tech businesses is more concerning than businesses in the service industry where transaction burdens (e.g. tax levels and exchange rates) are the main concern.

In general, entrepreneurs of small and start-up businesses need to overcome growth barriers that include the following:

- Small number of team members;
- Limited resources;
- Competitive environment;
- Lack of extensive networks;
- Bootstrapped infrastructure;
- Focus on the product, not on customer;
- Technical minds, but limited business skills;
- Lack of mentorship;
- Lack of support services;
- Short time frame to make it work;
- Lack of access to funding;
- Funded by the three F's (friends, family and fools);
- Extensive '*red tape'* business environment.

For the purpose of this research, generalised growth barriers have to be considered in the development of the conceptual framework, as the framework is not designed for a specific industry. In future research, adaptations of the conceptual framework can be made to gear the framework to support industry-specific start-up businesses and environments.

4.3. STRATEGIC MANAGEMENT OF START-UP BUSINESSES

In this section, an overview of strategic management models and practices will be discussed, with a specific focus on those relevant to start-up businesses. To start off, let us first discuss the definition and context of strategy and strategic management for this research study. Then specific chosen strategic management models will be discussed in more detail.

4.3.1. DEFINING STRATEGY

In literature, strategic management has been a prominent theme in the last century, especially over the last four decades, with numerous authors providing their input. However, the empirical research by Nag et al. (2007), has found that there has been no consensus in literature on what the definition of strategy is, but that businesses "*are dynamic and malleable, yet at the same time held together by a common, underlying, but permeable core*".

Wasserstein (2000) argued that due to the rapidly changing environment, market contradictions and limited resources require tough strategic decisions and good management along with the need for change. Mintzberg (1978) argued that most suitably, strategy is defined as the overall collection of business decisions and actions. Seddon & Lewis (2003) argue from another perspective, on what the relationship is between strategy and business models? They concluded that a strategy is unique to each business, but business models can be generic and a combination of business models can be used for developing new strategies for new and existing businesses. Furthermore, Wasserstein (2000) argues that the context wherein the definition of strategy is applied, greatly distinguishes different types of strategies and strategic management models.

Empirical research by Nag et al. (2007) also found patterns that strategic management mainly relates to business performance, the business as an entity, while subcomponents could include strategic initiatives and the business environment within which it operates. Porter (1996) who has developed numerous strategic models and was one of the leading authors in the field of strategic management, suggests that strategy consists of three key principles:

(1) The creation of a valuable and unique position through a different business model set of activities.

(2) Strategic decisions such as trade-offs in doing business and competing for market share.

(3) The creation of a '*strategic fit'* between the set of activities within the business model.

For the purpose of this research study, the definition of strategy will be related to start-up businesses in the context where start-up businesses are seeking business growth. Hence, the following definition of strategy will be used for this research study after considering the above-mentioned definitions and aspects:

> *Strategy is the initiatives based on the collective decisions and actions taken by management whereby the business aims to sustain a competitive advantage through the development of their business model. Therefore, strategic management considers a combination of business models and aims to position the business to create a business model that strategically fits best to the business in its market. It also thereby includes the strategic decision that needs to be made continuously based on validated learning, on whether to preserve, pivot or perish*[79]*.*

4.3.2. STRATEGIC MANAGEMENT MODELS

The field of strategic management consists of a vast amount of research conducted by various pioneers and experts. This led to the development of a host of strategic management and growth models, all being popularised by their due benefits and limitations, but fundamentally they are all based on a different definition of strategy (Wasserstein, 2000). Some of the more popular strategy models include:

- The Product Portfolio Growth-Share matrix by Henderson (1970; 1973) of the Boston Consulting Group, and can be defined as the internal alignment with regards to product portfolio management to the external strategic position aimed to acquire.
- Strategic Formulation by Mintzberg (1978) defined strategy as fluid, unpredictable and evolutionary of nature and consequently could not be planned.
- McKinsey 7S Strategy Formulation matrix by Waterman *et al*. (1980) can be defined as a tool for assessing the degree of internal alignment between the seven elements, but lacks external focus and integration aspects.
- Competitive Strategy and Porter's Five Forces model by Porter (1980) and Porter (1996) stressed that businesses operate in a competitive environment and require a well-planned strategy.

[79] Strategic decisions to *preserve, pivot or perish* is discussed below in strategic management models by Ries (2011), Eisenmann *et al.* (2011) and Javelin (2014).

- PESTLE-SWOT model and different versions of these types of model[80] have been extensively used in businesses which combined the PESTLE model analyses external factors which can be used for the SWOT internal analysis.
- The Strategic Intent by Hamel & Prahalad (1990) recommended that the required competitive advantages should be derived from the business core competency.
- The Blue Ocean Strategy by Kim & Mauborgne (2005) is similar to Porter's Five Forces in analysing the external environment and is used as a strategic positioning tool concerning market saturation and competition.
- The Strategic Fit model by Wiklund *et al.* (2009) which is built on internal and external alignment focused on integration for small business growth. However, it lacks practical application in implementing the conceptual model into the business.
- Eisenmann *et al.* (2011), researched the lean start-up methodology and strategy which is based on hypothesis-driven entrepreneurship whereby validated learning is done on all the business assumptions.

When considering the existing literature of strategic and growth models, it is clear that the majority of the strategies are geared more towards larger, established corporations (Wasserstein, 2000, p. 189). Therefore, it is important to note that the specific dimensions of small businesses are not the same as large businesses (Pasanen, 2006). It is further iterated that the widely accepted and successfully implemented strategies are more geared towards larger, established corporations (Majumdar, 2008).

Larger, established corporations and companies possess a more complex and sophisticated organisation planning, control functions and administration system as compared to a less-formal structure for smaller entrepreneurial businesses (Majumdar, 2008). The research by Patel (1995) recommends that a niche market can be created by a carefully developed strategic growth plan followed by a high degree of entrepreneurial implementation.

According to Nooteboom (2002), small businesses consequently are more flexible, can create closer customer relations and implement the business vision more easily. Nooteboom further iterates the drawback that they lack financial, technological and human resources with less market information and ultimately they lack the necessary economies of scale. Ries (2011) described that "*the fundamental activity of a start-up business is to turn ideas into products, measure how customers respond, and then learn whether to pivot or persevere*", while the research of Changati (1987) found "*that strategic flexibility is a critical requirement for small businesses*".

[80] *The original SWOT analysis has an unknown origin. Andrews (1987) used it extensively in discussing corporate strategy, but in the online article by Northumbria University (2014) the PESTLE-SWOT combined strategic tool is discussed.*

For the purpose of this research study, the lean start-up methodology[81] and the strategic fit methodology will be discussed in more detail in this section. These two models have been selected as they best fit the development of start-up businesses and can be used for the conceptual framework.

4.3.3. LEAN START-UP METHODOLOGY AND STRATEGY

The lean start-up methodology is based on the process of hypothesis-driven entrepreneurship and consists of five main principles. These five principles of the lean start-up methodology are (Ries, 2011):

(1) Entrepreneurs are everywhere: The entrepreneurship concept includes all people working within a start-up business, which is defined as a "*human institution designed to deliver a new product or service under conditions of extreme uncertainty*" (Ries, 2011). This definition ignores differentiators such as size of businesses, the specific industry and economy sector, making it usable even in large businesses.

(2) Entrepreneurship is management: Ries defines a start-up as creating an institution, not as an invention. This requires practices and principles that are geared towards start-up businesses that operate under extreme uncertainty. This is also discussed by Stevenson & Jarillo (1990) as a new paradigm on entrepreneurship.

(3) Validated learning: Ries defines start-ups with a vision to learn and not just to create inventions, make money or serve customers. This learning is aimed towards building a sustainable business that scientifically validates its learning through continuous experiments testing their assumptions against their vision.

(4) Build-Measure-Learn: Ries defines the fundamental purpose of start-ups as the process whereby ideas are turned into products or services, the customer responses are measured, and validated learning is done from feedback to make critical decisions on whether to persevere or pivot. Successful start-ups are geared towards accelerating this feedback loop process. Refer to Figure 4.1 below for conceptual illustration of fundamental lean start-up methodology and the feedback loop.

(5) Innovation accounting: This is a management process whereby entrepreneurial output is improved, and innovators are held accountable, through measuring progress, setting of milestones and prioritising work schedules. This is an accounting management setting specifically tailored for start-ups to manage accountability.

[81] Read Steve Blank's (2013) article on "*Why the Lean Start-Up Changes Everything*".

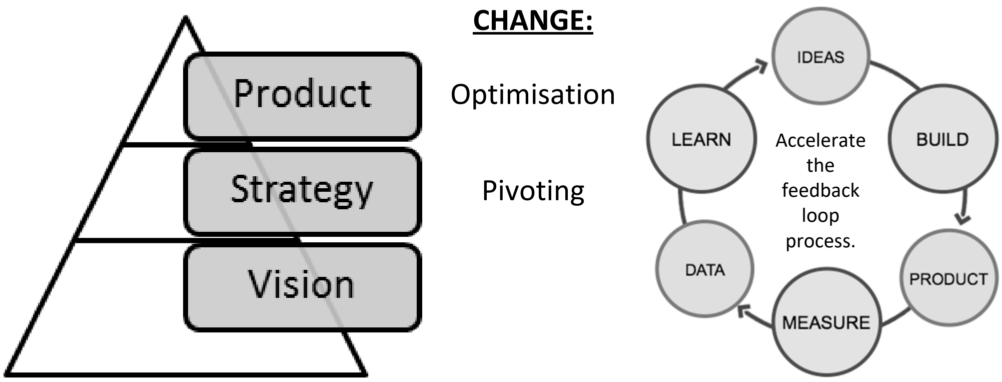


Figure 4.1: The Foundation of the Lean Start-up Methodology adapted from Ries (2011)

In Figure 4.1 above, the fundamentals of the lean start-up methodology are conceptually illustrated. This Hypothesis-Driven Entrepreneurship process can be summarised in Figure 4.2 and consists of the following:

(1) Developing the start-up vision;
(2) Strategies for translating the vision into hypotheses;
(3) Specifying the tests on the minimum viable product;
(4) Prioritise the tests;
(5) Validated learning on the tests;
(6) Persevere, pivot or perish;
(7) Continued optimisation and scaling.

The Hypothesis-Driven Entrepreneurship stepwise process mentioned above specifically relates to the numbering in Figure 4.2, and each step of the process will be discussed in more detail below.

4.3.3.1. DEVELOPING A VISION

The vision is a problem the start-up business addresses and strives towards a potential solution before the entrepreneur generates the business model hypotheses). The initial step of developing a vision also called the ideation which is a broad topic. Berkun (2010) defines the following general guidelines for generating an entrepreneurial vision as gleaned insights:

- **Clarification:** This is a process employed by numerous investors that continuously track and refine their ideas and inventions. For example, entrepreneurs write blog posts forcing them to sharpen and integrate their ideas, but also to receive helpful responses potentially from others. Another example is that design thinkers use journals or post-it notes, while entrepreneurial teams often use '*white boards*' to help generate, clarify and prioritise ideas and/or projects.
- **Collaboration:** This is a process whereby inventors work in small groups and surround themselves with other great thinkers. This is because researchers have dismissed the lone genius inventor myth as collaborators can stimulate other new ideas while providing support throughout the creative process. For example, Thomas Edison (also recall the '*Edisonian'* approach in Chapter 3) surrounded

himself with collaborators at his laboratory in Menlo Park, New Jersey. Other examples of collaborating small teams include Lennon and McCartney, Bill and Paul, Jobs and Wozniak, or Brin and Page.

- **Facilitation:** Creative workshops combine collaboration and brainstorming sessions that allow creative ideas and solutions to potential problems the entrepreneur envisions. For example, Charles Maisel (2011) developed an ideation technique called "*Seeing the Leaves*" whereby newspapers are used to spot multiple ideas.
- **Immersion:** This process involves an in-depth immersion into the problem, usually following initial creativity brainstorming. For some problems, such as consumer markets, the entrepreneur's own experience is adequate for the ideation required. For other problems, such as identifying the potential solution or unfulfilled needs of business-to-business markets, the entrepreneur can draw from specific domain knowledge (usually acquired from years of experience). Using the techniques of anthropology, interaction and observation with domain experts and/or customers can also provide adequate learning in the immersion into the problem process.
- **Incubation or '*Eureka*':** This is similar to the approach described in Chapter 3, a '*flash in the pan*' or '*Eureka'* moment. The inventor remains subconsciously engaged with the problem, usually because of distractions of other priorities and/or frustrations with barriers whereby the work is neglected for long periods, until the moment of epiphany about the solution.
- **Obsession:** This is where creative individuals develop an obsession with the problem they are working on. They are totally invested in solving the problem and are not excessively devoted to their conceived provisional solutions in their ideation process. They are willing to abandon flawed concepts, reconsider assumptions and are open to new ideas, as they are aware of the natural process of failing to succeed.
- **Recombination:** This is a process whereby new ideas come from connecting unrelated concepts. This is usually achieved when creative individuals situate themselves in the scenario where they are exposed to diverse ideas, which enables them to harness alternative thinking abilities.

In literature, some creative experts reject the notion of an innovation playbook, but there seem to be plenty of ideation approaches. The importance for entrepreneurs is to use these practices to generate as many ideas as possible, including wildly radical ones (Maisel, 2011), as well as to connect the dots between ideas and avoid negative idea evaluation, but to always take as much feedback as possible (Berkun, 2010). Entrepreneurs should also become acquainted with the crude prototyping process design thinkers utilise in order to accelerate the lean feedback loop (Kelley, 2001).

4.3.3.2. STRATEGIES FOR TRANSLATING THE VISION INTO HYPOTHESES

After developing the vision, the entrepreneur translates it into falsifiable business model hypotheses. In this process of developing the business model, there are two very handy tools, namely, the experimental board (Figure 4.3) and the business model canvas (Figure 4.5) which will be discussed in more detail later.

The business model consists of the integration of an array of distinct components that together produce the unique value proposition to customers and how the activities are configured. According to Eisenmann (2011a), the key components of the business model are the value proposition, '*go-to-market*' plan/strategy, operations and technology management strategy, and profit formula.

Eisenmann *et al.* (2011) further define that developing a business model through a set of falsifiable hypotheses needs to be consistent and aligned with the start-up business vision. The reason for the falsifiable hypothesis scientific method is that a hypothesis can only be determined falsifiable if experiments either reject or validate the hypothesis. Entrepreneurs should, therefore, attempt always to generate hypotheses which can be validated with quantitative metrics. However, when a hypothesis is not falsifiable, Ries (2011) argues that the entrepreneurial team "*plan is see what happens*" and that "*the team is guaranteed to succeed… but won't necessarily gain validating learning*".

However, developing a detailed hypothesis for every component of the business model could be a waste of time. Eisenmann *et al.* (2011) then argues that the iterative and continuous business model analysis process requires some assumptions to be sequentially reliant on each other. Therefore, a detailed analysis by entrepreneurs of all the downstream components is not necessary for evaluating opportunities. This is because the aim of the business model analysis is:

- Detect potentially '*deal breaker*' issues early on;
- Detect internal inconsistencies between business model components;
- Stimulate a search for solutions addressing the problems detected in the analysis.

4.3.3.3. SPECIFYING THE TESTS ON THE MINIMUM VIABLE PRODUCT

Entrepreneurs are challenged with uncertainty, limited capital and resources, and are typically a small team, making it essential to maximise the learning per unit time and effort exhausted. The optimal accelerated learning is to "*launch early and often*" (Graham, 2005). Traditional market research techniques such as focus groups and customer surveys can resolve uncertainty, but for more overview of research techniques suited for early-stage start-up businesses, refer to the research by Cespedes *et al.* (2011). However, this is not the purpose of this research study and will not be discussed in more detail. The notable focus is for the entrepreneur to receive more reliable feedback when real products are in the hands of real customers in the real-world context.

The '*launch early and often'* approach is achieved through specifying a *minimum viable product* (MVP). This is the smallest set of features and/or activities needed to complete what Ries (2010) calls a "*build-measure-learn*" cycle which tests the hypothesis of the business model. Utilising a series of MVPs approaches yields two main advantages, namely, the reduction of batch sizes and cycle times in product development which is described as follows (Reinertsen, 2009):

(1) Using small batches to release feature amendment provides easier interpretation of test results, diagnosing problems and reducing bugs through trial and error.

(2) Using short cycle times in product development, accelerates the feedback loop whereby entrepreneurs learn more about what the customer requirements are, before redundant features are built in.

On the other hand, MVPs drawbacks compared to scaling aggressively are product functionality and/or operational capability. Eisenmann *et al.* (2011) argues that start-up businesses with constrained operations, rely on temporary and improvised technology to deliver the functionality of the MVPs. Other common concerns regarding MVPs are exposure to idea theft, overreliance on early adopters and reputational risk.

4.3.3.4. PRIORITISE THE TESTS

This step follows after the business model hypotheses are generated, and the MVP specifying tests are completed, and requires sequencing of the priority tests. The general principle being to prioritise tests that mitigate high-risk assumptions at a low cost, e.g. freedom to operate or patent infringement search (Ries, 2011). Another general principle is that the entrepreneur is required to sequentially experiment and test serially dependent business model components automatically with limited choice.

Parallel testing is another option for entrepreneurs when the respective hypotheses are not serially dependent on each other, and the start-up business has the necessary resources and capacity to do so. This approach can be especially beneficial in highly competitive markets where the '*winner-takes-all'* scenario (Ries, 2011). The scenario trade-offs with parallel testing are as follows (Eisenmann, et al., 2011):

- Hypotheses A and B are tested simultaneously, and decisively. If hypothesis A is rejected it means that hypothesis B is rendered irrelevant whereby the time and cost of doing test B are wasted.
- Hypotheses A and B are tested simultaneously, and both hypotheses are validated, means that the start-up business gains an edge on the '*time-to-market*'.

4.3.3.5. VALIDATED LEARNING ON THE TESTS

This is a step in the lean start-up process where validated learning from the data of specified tests on the MVP is aimed for. Eisenmann *et al.* (2011) stated that the interpretation of feedback data collected for testing hypotheses can have two potential surprises for entrepreneurs, namely, unexpected customer usage patterns and non-customer related information.

- **Unexpected customer usage patterns:** Customers consistently use the product in an unanticipated manner. This type of interpretation can come from measuring quantitative data or from qualitatively analysing the interactions with early adopters.
- **Non-customer related information:** Not all the business model hypotheses should be based on collecting customer data and patterns. Entrepreneurs should revise their hypotheses and include information sources such as the announcement from competitors, new legislation and regulatory actions, market introduction of new technologies, etc.

There are also two potential sources of error in the interpretation of collected feedback data that includes customer errors and 'entrepreneur biasness'. Eisenmann *et al.* (2011) define these potential sources as follows:

- **Customer errors:** Customers might state certain preferences, but that does not always resemble their true preferences (e.g. Facebook – revealing rather than stating user preferences).
- **Entrepreneur biasness:** Eisenmann *et al*. (2011) states that extensive psychological research indicates humans are vulnerable to cognitive biasness. This is extensively discussed in Eisenmann *et al.* (2011, p. 9–11) under the section of Lean Startup Psychology and falls outside the scope of this research study.

Ries (2011) states that it is vitally important that entrepreneurs are not blindsided by threats and/or miss opportunities because they were too focused on mechanically generating data to test their business model hypotheses.

4.3.3.6. PERSEVERE, PIVOT OR PERISH

Now what to do with the validated learning? After every feedback loop is completed, the entrepreneur needs to make a strategic decision on whether to persevere, pivot or perish. Eisenmann *et al.* (2011) and Ries (2011) define these strategic decisions as follows:

- **Persevere:** When validated assumptions on the MVP are collected from the business model hypotheses and feedback loop, with no prompted change in direction, the present path is persevered or continued in either continued optimisation of the product or preparation for scaling.
- **Pivot:** When the business model hypothesis is rejected by the MVP test and/or other feedback directs the entrepreneur to another more promising opportunity, the entrepreneur might elect the strategic decision to pivot. Examples of potential reasons for pivots are described by Eisenmann *et al*. (2011, p. 19) in their typology of pivots. Ries (2011) defines pivoting as the strategic change while retaining the start-up business vision. Eisenmann *et al*. (2011) argue that core aspects of a start-up business's vision is retained during the pivoting process. Nonetheless, pivoting is not necessarily the goal as it can be a costly and disruptive process. However, it shouldn't be avoided either as failure to pivot with flawed assumptions can be fatal to the success of the business.
- **Perish:** This is when the business model hypotheses are all rejected without any plausible pivoting option, whereby the most sensible option is to close down shop and perhaps consider starting something else.

4.3.3.7. CONTINUED OPTIMISATION AND SCALING

After continued possibly multiple feedback loops with all the critical business model hypotheses validated, the start-up business has achieved what is called *'product-market fit'* (Andreessen, 2007; Ries, 2011; Eisenmann, et al., 2011). This means that the start-up business has demonstrated '*traction*' (Van Zyl, et al., 2013) whereby there is a demand for the product by early adopters and a solid profit potential (Eisenmann, et al., 2011).

With the start-up business having found the right product for a specific market, it can adequately deliver value to its various stakeholders (including customers, employees, suppliers and partners). The next step is where the testing changes from "*business model validation to business model optimisation… [and] continuous improvement*" (Eisenmann, et al., 2011, p. 9). The start-up business is, therefore, ready to scale and it is therefore aimed aggressively to acquire additional required resources such as employees and infrastructure, as well as acquiring a rapidly growing customer base.

However, scaling a start-up business presents entirely new issues in itself. The key is to aim for sustainable growth while Eisenmann (2011b) and Eisenmann & Wagonfeld (2012) discuss numerous issues with regards to scaling. While Eisenmann *et al.* (2011) and Ries (2011) also sternly warn start-up businesses to avoid premature scaling.

For the purpose of this research study, the issues of scaling will be considered in the development of the conceptual framework. The entire lean start-up methodology as discussed and explained in detail above is illustrated in Figure 4.2 as a flow diagram below.

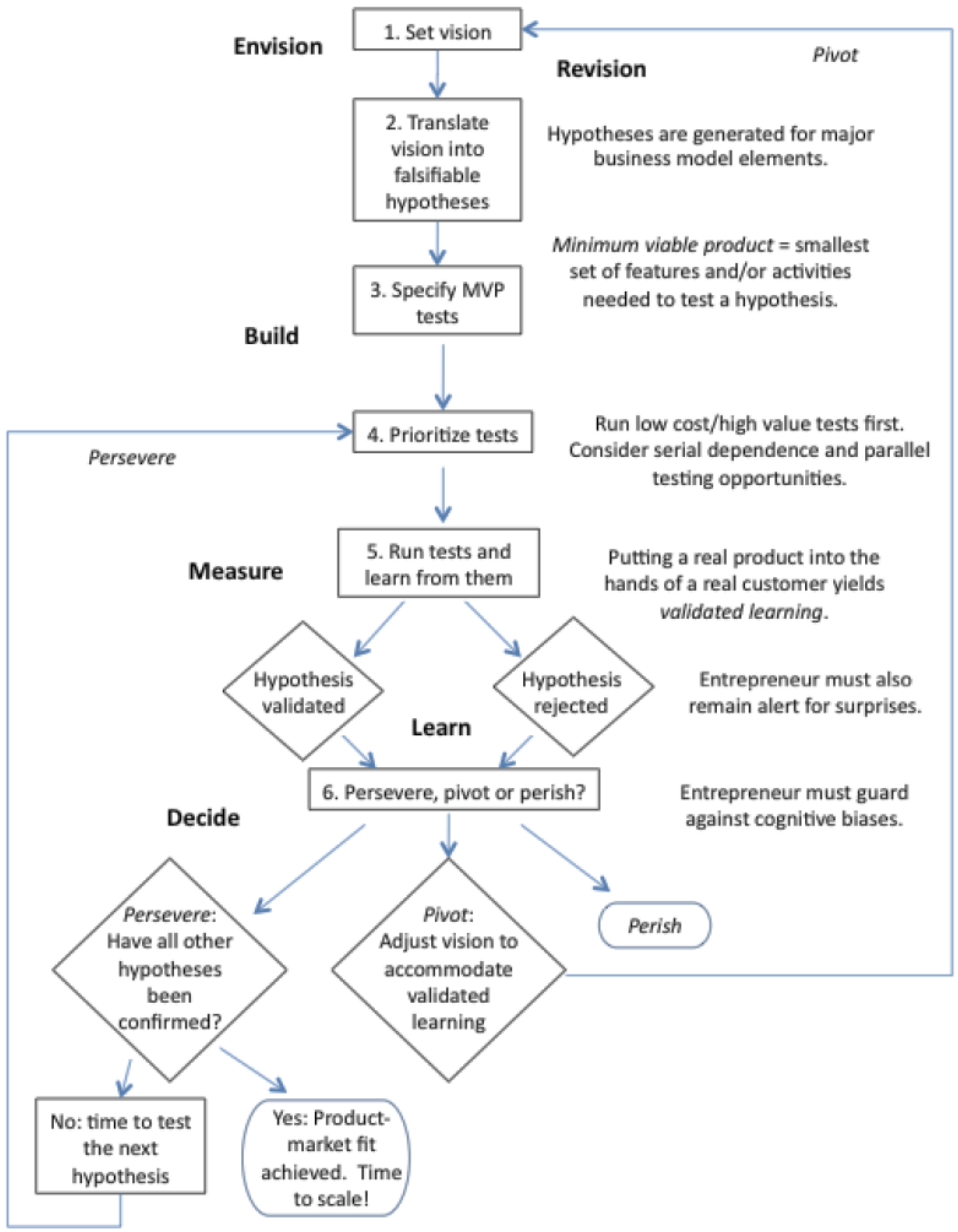


Figure 4.2: The Stepwise Hypothesis-Driven Entrepreneurship Process adopted from Eisenmann *et al.* (2011)

4.3.4. ADDITIONAL LEAN TOOLS

This section specifically entails two additional tools that can be used in developing business model hypotheses and further describes the importance and positive impact the lean start-up methodology has on making strategic decisions. The first lean tool is the experimental board developed by the Javelon (2014), while the second lean tool is a business model canvas, which was developed by Osterwalder & Pigneur (2010).

4.3.4.1. THE EXPERIMENTAL BOARD

The Experimental Board (EB) by Javelin (2014) is a conceptual tool based on the lean start-up methodology of hypothesis-driven entrepreneurship and the input and training of over 50 000 entrepreneurs and executives. The reasoning behind the development of the EB is that a high percentage of start-up businesses and product launches fail (also refer to Chapter 3), therefore it becomes essential to test before launching to mitigate the risks of failure (Javelin, 2014). This can be achieved as discussed in the lean start-up methodology, through developing experiments.

The process of utilising the EB starts with every experiment requiring a hypothesis to be formulated whereby large complex business ideas are focused and constructed into a hypothesis. It is essential that the hypothesis be formulated through wording the start-up business idea in a manner that can easily be tested. In the EB, the hypotheses can be broken down into three types, namely, relating to the customer, problem and solution. However, this process always starts with the customer, because Javelin (2014) argues that "*every customer has a problem and every problem has a solution, but not every solution has a problem and not every problem has a customer*".

The EB process is illustrated in Figure 4.3 below and is distinctly divided into two main areas; the brainstorming (or ideation) area and the execution area, and an additional help area providing some tips. The respective stepwise EB process is described as follows (Javelin, 2014):

- The first step involves brainstorming for the various customer segments involved.
- The second step involves selecting a specific customer segment to focus the experiment.
- The third step involves brainstorming various problems customers have.
- Then the fourth step involves selecting a specific problem to define your particular customer problem hypothesis.
- Note that the solution area is shaded to ensure that the experiment retains focus from a customer perspective and by focusing on understanding the customer and problem, the variables required to take into consideration are limited.
- The fifth step involves brainstorming the business model assumptions that are required to be tested, as every hypothesis has a set of assumptions.
- The sixth step involves selecting the riskiest assumption that allows the core liability of the business, meaning the assumption with the least data, biggest concern and/or most unknown.

- It is important to note that assumptions can be described as the actions, behaviours or mentality that the customer has to exhibit in order for a hypothesis to be true. However, how does one know when a hypothesis is true?
- The seventh step involves specifying the tests of the MVP (refer to p. 17) and collection technique whereby success can be measured. Eisenmann *et al.* (2011) and Ries (2011) discuss in more detail the different data collection methods and measuring of the data when quantitative or qualitative. While Javelin (2014) suggests three testing methods that are dependent on the amount of data available, where the lack of data requires more exploratory approaches to data collection, and includes:
    - **Interview:** Face-to-face interviews with customers that are the most exploratory of the three methods.
    - **Pre-sell:** This is when an entrepreneur sells a product before actually having developed the product yet which is becoming increasingly more popular with platforms such as crowdfunding.
    - **Concierge:** This is when the entrepreneur manually delivers a service for the customer and through interaction and experience, gains validated learning.
- In conjunction with step seven, the success criteria are set which is defined as the minimum amount of validation required in order to invest more resources, time and effort into proceeding with the project. This is usually set as a fraction, for example, out of the many customers interviewed, how many ('X') are required to exhibit action, behaviour or mentality.
- The eighth and ninth steps involve the result whereby a decision is required to be made, and validated learning is expected from collected data respectively. The decision that can be made is to either persevere, pivot or perish (refer to p. 19).
- If the result is invalid and the decision results in pivoting, then the validated learning involves the feedback loop whereby the same customer segment is approached with a new problem and risk assumption as indicated as the tenth step. Once the result is valid, (the eleventh and twelfth step) from the validated learning, a solution can be brainstormed in conjunction with the data collected.

The Javelin (2014) lean tool supports the entire hypothesis-driven approach seeking validated learning through the process. It is also a great conceptual tool to simplify and explain the practical application of the lean start-up methodology.

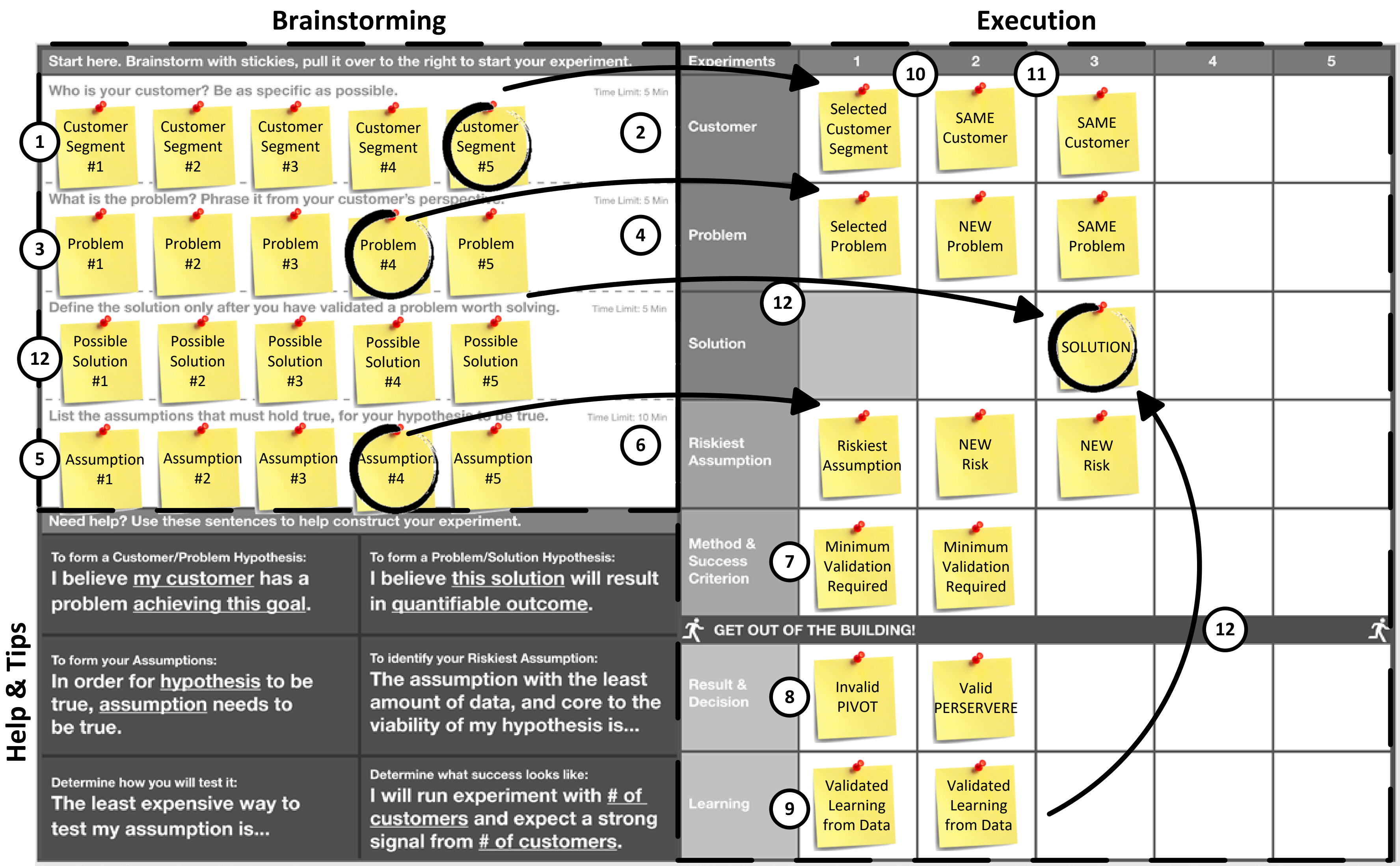


Figure 4.3: The Experimental Board adapted from Javelin (2014)

4.3.4.2. BUSINESS MODEL CANVAS

The definition of the business model has become a trending theme in literature in recent years as argued by Ver Loren Van Themaat (2011, p. 32). However, Osterwalder (2004) that the business model canvas integrates the various components required as indicated in existing research in the whole solution as showed it in the extensive research. Osterwalder & Pigneur (2010) then further developed the canvas as a conceptual tool to creatively and collaboratively brainstorm the business model of a business or organisation, while in conjunction with the lean start-up methodology, the business model hypotheses can easily be constructed.

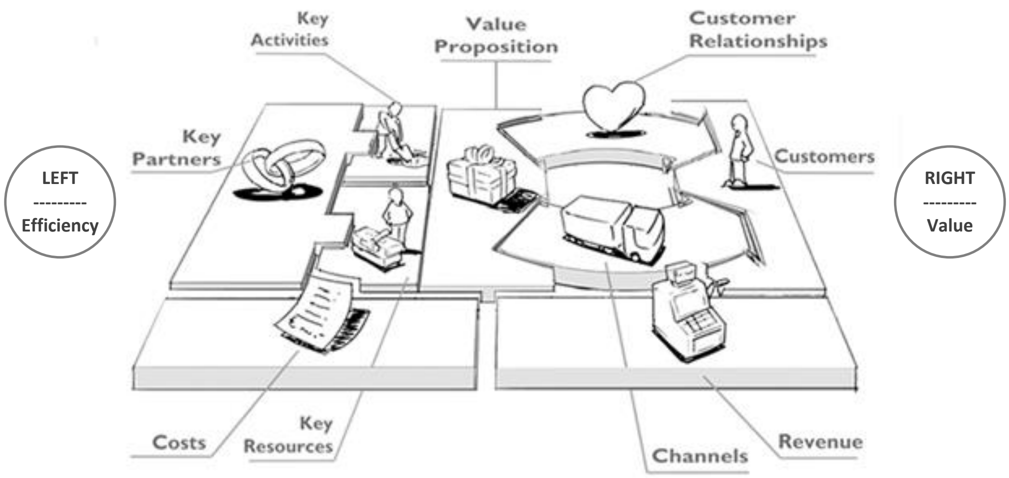


Figure 4.4: Business Model Canvas adapted from Osterwalder & Pigneur (2010, p. 19)

Osterwalder's (2004) business model ontology consists of four components, namely, product/technology, customer interface (market), infrastructure management and financial aspects. This is consistent with the research by Eisenmann (2011a, p. 16) which also defines four components, namely, customer value proposition, 'go-to-market' plan/strategy, technology and operations management, and profit formula. However, Osterwalder (2004) and Osterwalder & Pigneur (2010) took this further by subdividing the four components into nine business model building blocks, which are illustrated in Figure 4.4 above.

In Table 4.5 below, Osterwalder's (2004) and Eisenmann (2011) business model ontologies, as well as Osterwalder & Pigneur's (2010) nine building blocks of the business model canvas are summarised with the respective definitions. A summary of the questions and characteristics of each building block in the business model canvas is illustrated in Figure 5 on p. 27. Eisenmann (2011a) also observed and defined some generic business models which include:

- **Value-chain positioning approach** (e.g., franchise; platform);
- **Revenue-driven approach** (e.g., subscription, rental, "*razor & blades*");
- **Value-driven approach** (e.g., matchmaking, "*long tail*" aggregation, outsourcing);
- **Broad industry sector** (e.g., professional consulting services, packaged goods, creative industries);
- **Strategic industry positioning** (e.g., software-as-a-service; low-cost airline, open source).

Table 4.5: Summary of the Business Model Ontology and Canvas adapted from Osterwalder (2004), Osterwalder & Pigneur (2010), and Eisenmann (2011).

Main Component	Definition	Sub-Blocks	Definition	Comments
Infrastructure Management/ Technology & Operations Management	The effectiveness of a business performance is governed by the operations of infrastructure, technology, logistical components and network which is achieved with the key partnerships, activities and resources of the business.	**Key Partners**	The network of suppliers and partners that make the business model work.	<u>Three motivations for creating partnerships:</u> **(1)** Optimisation and economy of scale, **(2)** Reduction of risk and uncertainty, **(3)** Acquisition of particular resources and activities.
		Key Activities	The most important activities the business must do to make the business model work.	<u>Categories:</u> Production (efficiency), Problem Solving (Increment/Radical), Platform/Network.
		Key Resources	The most important assets required to make the business model work.	<u>Types of Resources:</u> Physical assets, intellectual capital, human capital, and financial capital.
Customer Interface/'Go-to-Market' Plan	This involves the business's target market and the specific channels and customer relationships used to offer the business value proposition to the specific customer segment.	**Customer Segments**	The different groups of people or organisations the business (target audience) that the business aims to serve with the business's value proposition.	<u>Different types of customer segments:</u> Mass market; Niche market; Segmented; Diversified; and Multisided markets.
		Customer Relationships	The type of relationship a business establishes with a specific customer segment.	<u>Types of Customer Relationships:</u> Personal assistance, dedicated personal assistance, self-service, automated services, communities, and co-creation.
		Channels	The delivering of the value proposition to customers through distribution, communication, marketing and sales.	<u>Channel Phases:</u> **(1)** *Awareness:* How do we raise awareness about our company's products and services? **(2)** *Evaluation:* How do we help customers evaluate our organisation's Value Proposition? **(3)** *Purchase:* How do we allow customers to purchase specific products and services?

Main Component	Definition	Sub-Blocks	Definition	Comments
				(4) *Delivery:* How do we deliver a Value Proposition to customers? **(5)** *After sales:* How do we provide post-purchase customer support?
Product/Customer Value Proposition	The business's overall bundles of products and services which satisfy a specific customer segment's needs with the value proposition.	**Value Proposition**	The business's overall bundles of products and services which satisfy a specific customer segment's needs with the value proposition.	<u>Type of innovation:</u> Radical, disruptive, incremental, process, paradigm, etc. (also refer to Chapter 3).
Financial Aspects/ Profit Formula	In order for a financially viable and sustainable business model, the profit formula needs to be analysed as the cost structures against the revenue streams.	**Cost Structure**	The elements of the business model resulting in the cost structure.	<u>Type of Business Costs:</u> **(1)** *Cost driven:* leanest cost structure, low price value proposition, maximum automation, extensive outsourcing. **(2)** *Value driven:* focused on value creation, premium value proposition.
		Revenue Streams	Revenue streams are resulting from the value proposition being successfully offered to the customers.	<u>Type of revenue streams:</u> Asset sale, usage fee, subscription fees, lending/renting/leasing, licensing, brokerage fees, and/or advertising. <u>Pricing mechanisms & strategy:</u> **(1)** *Fixed menu pricing:* List price, product feature dependent, customer segment dependent, or volume dependent. **(2)** Dynamic pricing: Negotiation/bargaining, yield management, 'real-time-market', auctions.

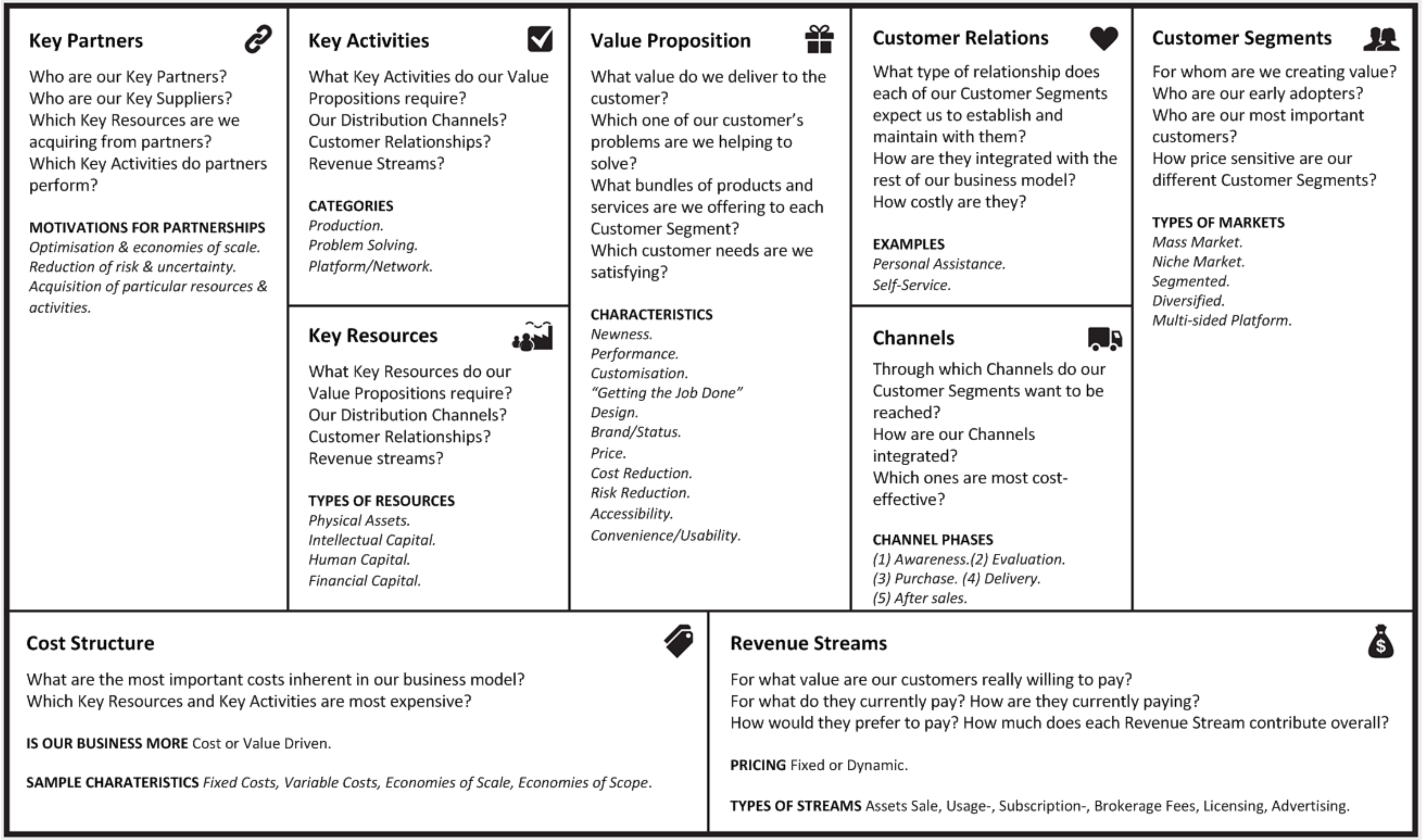


Figure 4.5: Summarised Business Model Canvas adapted from Osterwalder & Pigneur (2010)

4.3.5. THE STRATEGIC FIT MODEL

There is a consensus among academics that growth is a multidimensional phenomenon sculptured by various internal and external factors. Similarly, the '*strategic fit*' of a business in the field of strategic management has been discussed by leading authors such as Michael Porter, Henry Mintzberg, Bruce Henderson, Gary Hamel, Jim Collins, Liddell Hart, Carl Von Clausewitz and Sun Tzu with other tools and frameworks including SWOT & PEST analysis, Porter's Five Forces, Strategic Intent, and the Balanced Scorecard.

In this research study, the integrative model by Wiklund *et al*. (2007) was chosen for its role being geared specifically for small- and medium-sized businesses. The model also outlines several factors that affect the growth and '*strategic fit*' of a business which collectively creates the sustainable competitive advantage of the business resulting in small business growth. These outlined factors are entrepreneurial orientation (EO); the business environment; the available business resources; and the owner-manager's attitude. In Figure 4.6 below, the 'strategic fit' model is conceptually illustrated.

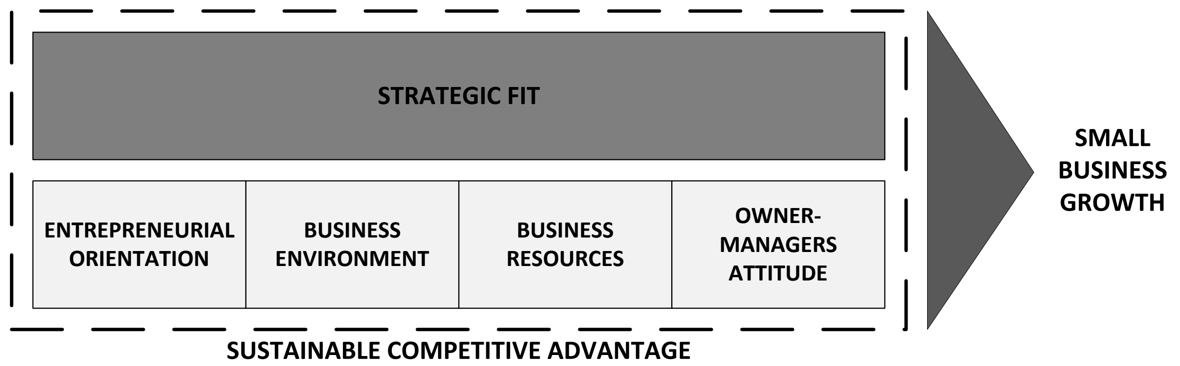


Figure 4.6: Strategic Fit Model for Small Business Growth by Wiklund *et al.* (2007)

4.3.5.1. ENTREPRENEURIAL ORIENTATION

In the research done by Miller (1983), Wiklund (1998) and Covin & Slevin (1989) they noted that the extent of entrepreneurial orientation (EO) or entrepreneurial activity of a small business is connected to the performance and growth of the business. The degree of the EO of the entrepreneurial business interacts with the strategic orientation and intent of the small business. It can therefore be summarised, as the business owner-manager's attitude towards proactively taking risks by investigating and implementing products and services to develop new market opportunities (Covin & Slevin, 1989; Miller, 1983; Namen & Slevin, 1993; Wiklund, 1999; Zahra & Covin, 1995; Zahra, 1993; Wiklund *et al.*, 2007).

Consequently, research further iterates that business ventures with a high degree of entrepreneurial orientation and cultural experiences have improved performance (Wiklund, 1999; Zahra, 1991; Zahra & Covin, 1995).This is important to businesses maintaining and enhancing their degree of EO as over time they are able to sustain high growth rates and outperform competitors (Madsen, 2007).

4.3.5.2. THE BUSINESS ENVIRONMENT

The environment within which a business operates, provides a growth opportunity that could be subjugated (Davidsson, 1989; Stevenson & Jarillo, 1990). Thus, the business environment can be described as the external factors affecting the delivery performance. Moreover, it is known that small business growth depends on the industry market (Aldrich & Auster, 1986) and the market maturity (Baldwin & Gellatly, 2003). Nevertheless, scholars found that high growth amongst small and medium businesses is due to their aptitude to develop market niches (Storey, 1997). Research by Wiklund *et al.* (2007) and others, categorised the different environments and their dimensions as follows:

- **Dynamic Environments:** Characterised by instability and continuous change.
- **Hostile Environments:** Threats that would decrease growth opportunity.
- **Environmental Heterogeneity:** Captures the complexity of the environment.

4.3.5.3. AVAILABLE BUSINESS RESOURCES

A small business is limited to the available business resources in order to grow and according to Connor (1991) and Wiklund*et al.* (2007), there are three distinctive resource concepts at their disposal in order to deploy a strategy to achieve a competitive advantage. These three distinct resource concepts are:

- **Resourced-based:** This is a combination of heterogeneous resources that the business uses to utilise the physical resources available in processes that create, discover and successfully exploit new market opportunities (Zahra, et al., 2006). Included in this type of resources are the financial capital available that limits growth (Hartarska & Gonzalez-Vega, 2006).
- **Human Capital Resources:** This is resources orientated on the human capital of the entrepreneurs that provides knowledge, skills and experience that enables the entrepreneur to see growth opportunities and effectively run their business to ultimately grow (Alvarez & Busenitz, 2001; Cressey, 2006; Koeller & Lechler, 2006).
- **Interpersonal Network Resources:** This is the interpersonal relationships of the owner-manager's social capital that allows the business to improve accessibility of information in order to reduce costs, seek new opportunities and ultimately exploit growth opportunities (Wiklund, et al., 2007).

The goal of these various resources is to combine optimally in order to utilise the opportunities that will drive a sustainable competitive advantage (Alvarez & Busenitz, 2001; Connor, 1991) and ultimately business growth.

4.3.5.4. THE BUSINESS OWNER-MANAGERS ATTITUDE

The business owner-manager's attitude is the underlining motive for the start-up and foresees the daily operations of the business, which as research has shown stretches beyond maximising economic returns (Storey, 1994). Sexton & Bowman-Upton (1991) argued that the growth attitude of the business owner-manager sets the limitation to the potential growth the business would achieve. This coincides with research by Douglas &

Shepherd (2000) as business owner-managers seek a variety of primary reasons to own a business such as fulfilment of noneconomic personal goals (e.g. independence, idea development). Wiklund *et al.* (2003) suggest that the entrepreneurs' initial ambitions may not initially include growth and that a tendency favourable towards growth can be developed after initial business growth success.

4.3.5.5. THE STRATEGIC FIT

The research community has long discussed that there is importance in achieving a 'fit' between the characteristics of the business and the environment it competes within (Andrews, 1987). This balance of various factors and the market it competes in is called the 'strategic fit'. Should a business be unsuccessful in balancing the necessary resources in attaining and sustaining a competitive advantage ensuring business growth, the business will wither and fail (Wiklund, et al., 2007).

4.4. GROWTH MODELS FOR START-UP BUSINESSES

In this section, different growth models will be discussed that are specifically focused on the development of small and start-up businesses. However, what is business growth? The definition of growth and its relationship with strategic management are required to be defined. Then different types of growth models are discussed and the best practice growth models for entrepreneurial start-up businesses are chosen for the use in the development of the conceptual framework of this research study.

4.4.1. DEFINITION OF GROWTH

In the existing literature, it is undeniably clear that growth is essential to the development of the business and the country. We do, however, remain with limited understanding of the actual growth processes that businesses undergo. This leaves us in dire need of understanding growth better, so let us start with what is growth?

According to Davidsson *et al.* (2010), the majority of literature based on small business growth neglects the process of growth and only considers as growth as an increase in amount (e.g. profitability or size). In the research by Penrose (1995), the term '*growth'* can be generally considered as having two different meanings:

(1) It at times signifies an increase in the amount of output, profitability, sales or exports.

(2) At other times, it signifies the enhancement in quality or an increase in business size consequent to the development of internal processes.

In more recent research, Ericson (2007) provides an alternative conceptualisation whereby growth is proposed to be '*lived*', instead of as an '*object'* that controls an individual. This conceptualisation describes growth development through social practices providing exposure and manifestation of complex and interconnected human activities. Eisenmann *et al*. (2011) and Ries (2011) uses validated learning whereby the strategic decisions to persevere, pivot or perish can also be seen as correlation between growth whether negative or positive.

In the research by Phelps *et al.* (2007) a new perspective on growth is provided, based on a knowledge management concept of learning and innovation. It is described as a business or organisation's absorption capability in order to transition (‘*tipping points*’) between ‘*growth states*’. This absorption capability is defined to consist of six elements which include (refer to Figure 4.7 on p. 37 for a conceptual illustration):

- People Management
- Strategic Orientation
- Formalised Systems
- New Market Entry
- Obtaining Finance
- Operational Improvement

There is a wealth of research studies investigating the socio-economic significance of business growth and the determinants driving or limiting business growth. Pasanen (2006) described that the socio-economic benefits of small and medium businesses will be attained, if the business ultimately survives and is successful in maintaining the “*continuity of business*”. Story (1994) further argues this as he proposes that the longevity of small and medium businesses is tantamount to the business growth and that businesses with stagnant or a decline in growth lack longevity. Additional benefits for business growth increase the following aspects (Storey, 1994):

- Increase in the scale of economies;
- Increase in market share;
- Increase in profitability;
- Increase in new business opportunities;
- Increase in market credibility;
- Increase in firm market value.

However, the perspective that growth is not necessarily profitable is extensively argued by Davidsson *et al.* (2010, p. 56) where they found that there is no empirical evidence validating the relationship between business profitability and growth. They also state that small business owner-managers should, “*whenever possible, secure a sound level of profitability before they go for growth*”, as profitability is a source for future growth and development.

In this research study, the definition of growth of Penrose (1995) and Phelps *et al.* (2007) will be used. However, an additional three dimensions will be considered relating to small and start-up business growth whereby value is created in order to grow. These three dimensions dictate the different understandings and perspectives of value as follows:

(1) Penrose (1995) bases the first dimension on the research whereby growth is signified by an increase in the amount relating to output, profitability, sales or exports. This is rather self-explanatory and widely accepted as business growth is defined by its output. However, optimisation and margins are not the only forms of value start-up businesses or organisations have which leads to the alternative two dimensions.

(2) The second dimension is based on the research by Penrose (1995) and Phelps *et al.* (2007) as the internal absorption capacity to learn and innovate, and development processes to enhance overall quality and increase size through continuous implementation of knowledge.

(3) The third dimension is based on the research by Phelps *et al.* (2007) (*element of strategic orientation*), Eisenmann *et al*. (2011) and Ries (2011), which governs the understanding around the strategic decision of pivoting after a continued process of validated learning. This step of pivoting could mean taking a step back to go two forward. For example, new market entries have made your products obsolete, which requires the business to pivot into a new market or perish. The initial steps could result in retrenchment of employees, loss in output, profits and quality that are in all senses negative growth, but has the opportunity to flourish again potentially in the future.

4.4.2. GROWTH MODELS AND THEORIES

In reviewing the literature on growth models and theories for small business development, O'Farrell & Hitchens (1988) categorised the business growth theories into four main categories, while a fifth and a sixth category are argued by Phelps *et al.* (2007) and Levie & Lichtenstein (2008) and are described as follows:

1) **Static equilibrium theories:** these are theories originating primarily from industrial economies preoccupied with attaining financial prudence and reducing of long-term costs while inadequately concerned with the growth dynamics of the business.
2) **Stochastic models:** these are theories originating primarily from economies which suggest that there are "*many factors that affect growth*" and consequently, there is no principal theory for business growth.
3) **Strategic growth models:** these are theories which incorporate a dimension of strategy into achieving sustainable growth through what the '*owner-manager*' aspires to achieve with their business, considering the opportunities and constraints they sees. Sustainable business growth is achieved by identifying the business policies, strategies for business conduct and development, and '*owner-manager's* business vision which consequently translates into managerial actions.
4) **Stage or phase growth models:** these are theories originating primarily from economies where the growth development of a business is observed as a linear series of stages or phases through which the business develops in a business life cycle.
5) **States growth models:** these models are based on the theory that businesses develop and grow through a unique series of stable and unstable states that relate specifically to that individual business's managerial problems and challenges or '*tipping points*'.

The two most dominant theories in the literature to explain the phenomena of small and medium business growth are the strategic growth models and the stage growth models. While these two models remain predominantly within literature, McMahon (1998) and Achtenhagen (2004) warn academics to avoid '*reinventing the wheel*'. An important suggestion emanating from criticism of the phase or stage growth models by Miller (1981, 1987) and Kazanjian (1988), was that business might instead of moving predictably through a sequential business life cycle, develop through attaining 'gestalts' or patterns of environment, structure, and strategy that may materialise for various reasons. Miller & Friesen (1984) and Kazanjian & Drazin (1989) views that the complexity of business and the growth patterns associated with it, all tend to influence one another and that growth development is not set in stone, meaning that any business would not necessarily follow any developmental pattern, further iterate this.

In the research by Levie & Lichtenstein (2008), 104 stage or phase growth models were analysed and found to neither possess a consensus on basic constructs, nor indicate any empirical confirmation of the stage or phase theory. Similarly, the research by Phelps *et al.* (2007) and Davidsson *et al.* (2010) also strongly argued against the seemingly dominant growth model found in the literature. The static equilibrium and stochastic models only shed some light of interest, but fail to fully clarify the process of small and medium business growth (McMahon, 1998). From the review of literature, it is clear that providing critique on contemporary theories is far easier than providing conceptual and explanatory frameworks within which small and medium businesses grow, considering the realities are not free from criticism (O'Farrell, 1988; Gibb, 1989, 1990, 1991).

The truth is that we are still in darkness about the true understanding of the complexity of the growth within businesses of various ages, sizes and industries. Two other aspects considered for growth are the impact of internationalisation on a business and seeing the increasing impact of start-up businesses globalising, while the role of organic growth versus acquisition growth is a whole other debate (Davidsson, et al., 2010). For the purpose of this research study, states growth models best describe some of the complexity surrounding growth and it is chosen specifically for supporting the understanding of the enterprise engineering processes of the conceptual framework.

4.4.3. GROWTH STATES MODEL

4.4.3.1. ABSORPTION CAPACITY/TIPPING POINT GROWTH STATES MODEL

Phelps et al. (2007), Levie & Lichtenstein (2008), and Davidson et al. (2010) extensively and convincingly argue for this movement towards a dynamic states model of entrepreneurial growth and change. The growth states model is based on two dimensions; firstly, the typology of key issues surrounding growth businesses face and secondly on the concept of absorption capacity.

The typology of key issues surrounding growth is shaped by the work of Gladwell (2000) and is based on the notion of tipping points. This essentially evolves from the norm of business growth as a preset sequence of stages and argues that businesses each have their "*own unique series of stable and unstable states relating to specific managerial problems*" (Phelps, et al., 2007). The notion of tipping points is the managerial problems that are required to be overcome causing change and evolution from an initial relatively stable situation.

The absorption capacity model is based on the work of Cohen & Levinthal (1990) and conceptually describes the business's ability to acquire and utilise new knowledge to overcome the tipping points or managerial problems. The absorption capacity model is divided into six tipping points, which are briefly described as follows (Phelps, et al., 2007):

- **People Management:** Effective people management skills can be regarded as a prerequisite in developing and improving small and start-up businesses as they grow. However, more research on the specific people management skills and associated challenges to overcome is required.
- **Strategy Orientation:** The strategic implications of growth should move away from reactive and opportunistic strategising, and move towards considered and deliberate strategies. Generally, start-up businesses focus on niche strategies to compete competitively against larger organisations. Strategising with a lean start-up approach and tools can be considered the route forward.
- **Formalising Systems:** There are two opposing effects of formalising systems, firstly the advantage as ad hoc systems are replaced with formal systems, and secondly the disadvantage of solidifying and embodying formal systems. Essentially this is a change management process which start-up businesses that have ambitious aims to grow into larger organisations are required to implement and manage.
- **Market Entry:** Entering or moving into new markets is essentially the adoption or replicating the existing business model to a new market or the developing of new products for an existing market and customers.
- **Obtaining Finance:** In the process of growing start-up businesses, obtaining external funding can be expected to scale the business essentially into a new state. This is also commensurate with new external pressures and constraints from external financing.
- **Operational Improvement:** This includes the continuous awareness and understanding of the capabilities and the implementation of best practices to improve processes effectively and efficiently to remain competitive.

In Figure 4.7 below, these two dimensions of the tipping points and the absorption capacity are integrated into a maturity model that proposes that small and start-up business growth is based on a series of potential learning states. These learning states are classified into four levels that the growth of businesses occupies and addresses in relation to the tipping points (Phelps *et al.,* 2007; Hayes, 2010):

- **Ignorance State:** The base state whereby businesses do not realise the importance of the key issues, challenges and/or risks they are facing.
- **Awareness State:** The second state is where the business is aware of the key issues, challenges and/or risks, but is not actively aware nor possesses the knowledge to resolve the issues.
- **Knowledge State:** The third state is where new knowledge is actively sought or passively acquired in order to resolve the emerging issues.
- **Implementation State:** The last state where the acquired knowledge is implemented to achieve real and lasting change.

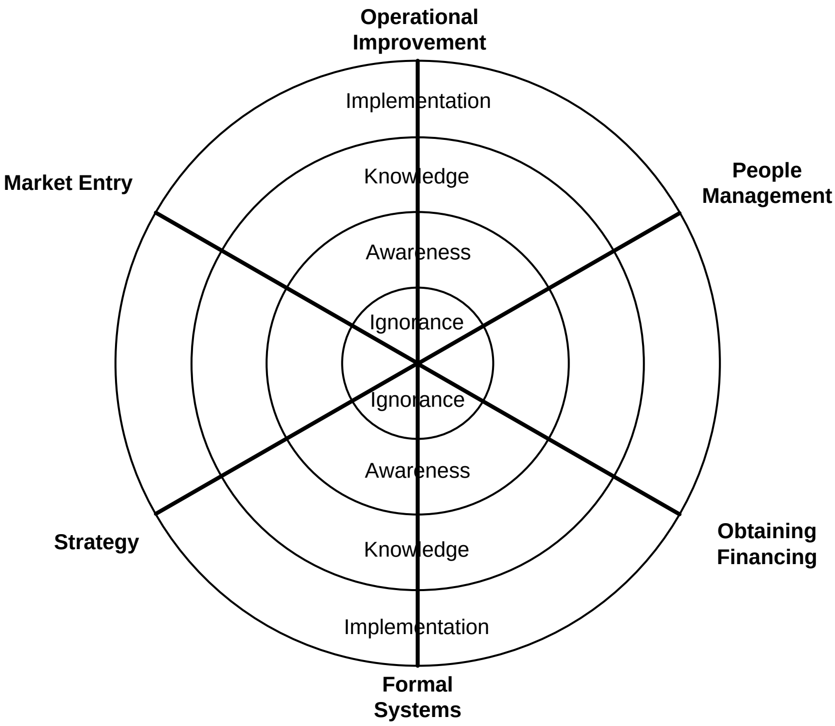


Figure 4.7: Business Growth States Absorption Capacity/Tipping Point Framework adopted from Phelps *et al.* (2007)

4.4.3.2. LEAN GROWTH METHODOLOGY

The lean growth methodology is a combination and integration of multiple existing models to support entrepreneurship and innovation specifically. This lean growth methodology integrates the following concepts:

- Lean start-up methodology developed by Eisenmann *et al*. (2011) and Ries (2011);
- Tipping points developed by Gladwell (2000) and further utilised by Phelps *et al.* (2007);
- Absorption capacity developed by Cohen & Levinthal (1990) and further utilised by Phelps *et al.* (2007).

The purpose of this lean growth methodology is to align external requirements with internal resources and systems to produce a value proposition. The process of alignment requires to be continuously iterated to validate learning and support the innovation process. The external requirements are defined as the stakeholders and entities that are considered as important to a start-up business. This includes market needs and wants, and obtaining financing from investment organisations.

The internal alignment is defined as the alignment of the business resources and financial roadmap with the external requirements. Through integrating this absorption capacity/tipping point growth model by Phelps *et al.* (2007). with the fundamental principle of validated learning of the lean start-up methodology by Eisenmann *et al*. (2011) and Ries (2011), a lean growth methodology can be created. The internal alignment of the different start-up business components for the different states requires a validated learning process whereby business model assumption is validated.

The external requirements can also be seen as different tipping points (Gladwell, 2000) and are distinguished by the different states a start-up business goes through. In Chapter 2, Table 2.21 the work by Smith *et al.* (2011) is combined with the work by Van Zyl *et al.* (2013) to produce requirements of the states that start-up businesses typically need to overcome. The multiple fluctuation of states requires decision-making based on the lean start-up process of validated learning implemented through the alignment of internal resources and systems. This lean growth methodology is synthesised and illustrated in Figure 4.8 below, but it is merely to serve as a conceptual amalgamation of different concepts and ideas to support entrepreneurs.

4.5. CHAPTER SYNTHESIS

In this chapter, a literature review on start-up businesses and entrepreneurship was done, with a particular focus on identifying best practices from the literature. The objective was to answer the set of SRQs that are defined in Table 1.1, and include SRQ:4.1–4.13.

The SRQs answered in this literature review, as well as their outcome and significance, are synthesised in Table 4.6 below. The significance of the answered SRQs are used in Chapter 6 in the development of the conceptual framework, while the objective of this chapter (refer to Table 1.2) was successfully achieved as follows:

> **[SRO:4.0]** ***Develop an understanding of the dynamics revolving entrepreneurial start-up businesses in terms of challenges, strategy and growth models***.

The objective is achieved after answering the SRQ:4.1–4.13.helped determine the best practice in start-up businesses and entrepreneurship, while answering the SRQ:4.6–4.13 helped determine the best practice in strategy and growth models for start-up businesses.

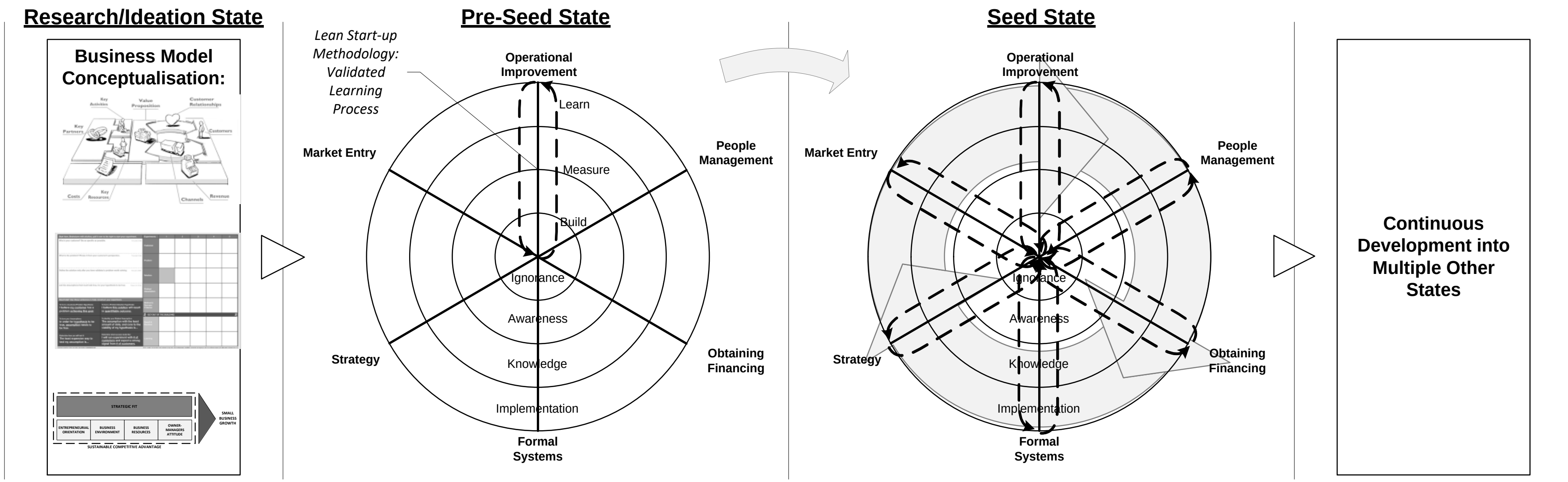
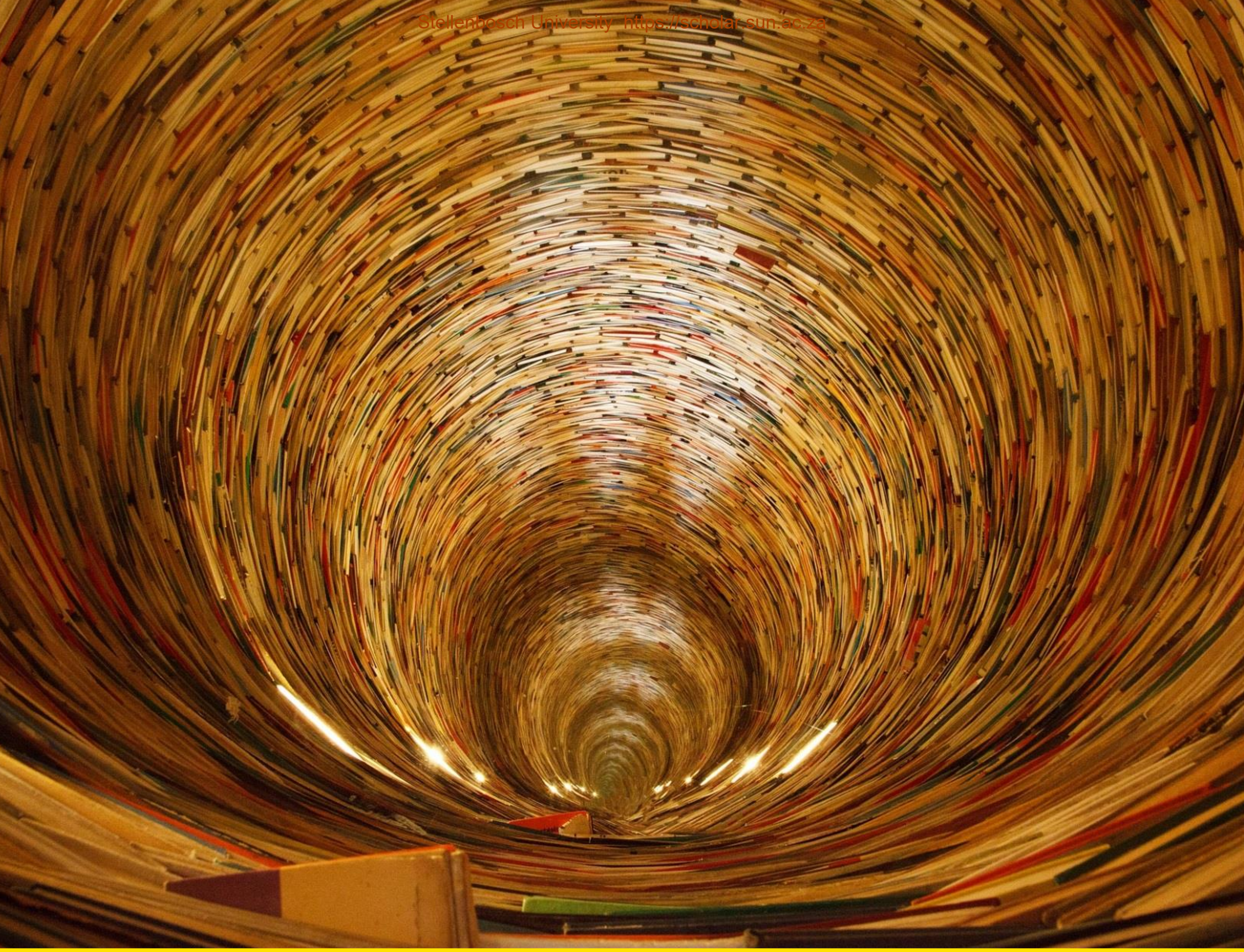


Figure 4.8: Lean Growth Methodology

Table 4.6: Synthesis of the Sub-research Questions and the Related Literature Review of Chapter 4

Ref. Code	Sub-research Questions	Related Section	Outcome Achieved	Significance
RSQ:4.1	*What is the role of the entrepreneur in a start-up business?*	§4.2.1	Yes	**FDC: 2.1** The enterprise innovation process of the framework should enable a hypothesis-driven entrepreneurial approach.
RSQ:4.2	*What are the different entrepreneurial approaches?*	§4.2.2	Yes	
RSQ:4.3	*What are the differences between management and entrepreneurs?*	§4.2.3	Yes	**FDC: 2.3** The enterprise innovation process should include entrepreneurial teams, not individuals and also include management practices of the innovation process.
RSQ:4.4	*What are the barriers and inhibitors of start-up business developing?*	§4.2.4	Yes	**FDC: 2.2** The framework should mitigate numerous start-up business growth challenges, both internal and external.
RSQ:4.5	*What are the components of business growth?*	§4.4.1 & §4.2.4	Yes	
RSQ:4.6	*What is the definition of strategic management for start-up businesses?*	§4.3.1	Yes	**FDC: 2.4** The enterprise innovation process of the framework should fundamentally include the lean start-up methodology and the strategic fit model.
RSQ:4.7	*What is the role of strategy?*	§4.3.1	Yes	
RSQ:4.8	*What are the different strategic management models for start-up businesses?*	§4.3.2	Yes	
RSQ:4.9	*What is the definition of growth for start-up businesses?*	§4.4.1	Yes	**FDC: 2.5** The enterprise innovation process of the framework should fundamentally include the growth states models.
RSQ:4.10	*What are the different growth models and theories for start-up businesses?*	§4.4.2	Yes	
RSQ:4.11	*What is the lean start-up methodology?*	§4.3.3	Yes	
RSQ:4.12	*What is the growth states models for start-up business?*	§4.4.3	Yes	
RSQ:4.13	*What is the lean growth methodology for start-up businesses?*	§4.4.3.2	Yes	



5 Knowledge Management and Cooperative Models

This literature review focuses on knowledge management and cooperatives. It includes an overview of the dynamics of integrated knowledge networks and models as well as the dynamics of cooperatives and their respective models. The review evaluated the best practice models and defines the tools and concepts required for the framework.

5.1. INTRODUCTION

In today's modern business world, markets are dynamic and ever-changing while also being characterised by continuous technological advancement (Bornemann, et al., 2003; Marr *et al*., 2004). This requires organisations to be more flexible and effective in continuously innovating to sustain their competitive advantage (Hayes, 2010). This is illustrated in Figure 5.1 below as 'knowledge' becomes the basis for an organisation to develop into a learning organisation and the essential driver to continuously innovate and sustain their competitive advantage (Bornemann, et al., 2003; Hayes, 2010).

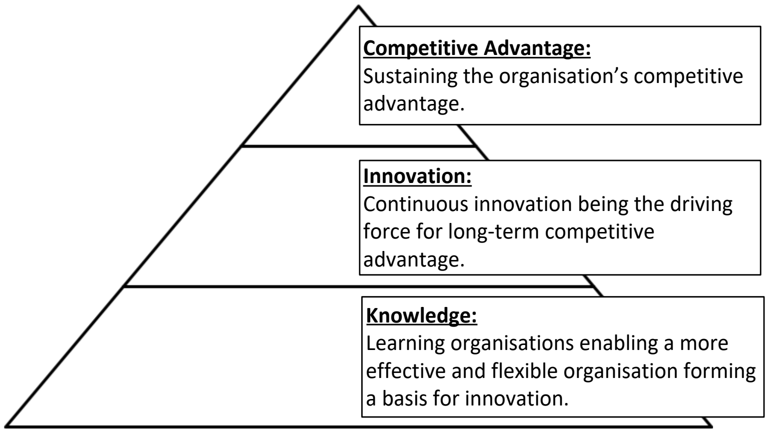


Figure 5.1: Knowledge Forming the Basis of an Organisation's Competitive Advantage adapted from Bornemann *et al*. (2003) and Schutte (2010)

In this chapter, the discipline of knowledge management and the organisational entities of cooperatives will form the core of this literature review, in order to develop a better understanding of the best practices involved in knowledge management and cooperatives. The set of SRQs for this chapter is defined in Table 1.1 and includes SRQ:5.1-5.X. The subsequent objectives of this chapter are listed as three distinct objectives and include the following (refer to Table 1.2)*:*

[SRO:5.1] ***Determine the best practices of knowledge management and networks models.***

[SRO:5.2] ***Determine the best practices of cooperative models.***

[SRO:5.3] ***Develop an understanding of the dynamics of cooperatives in South Africa.***

The purpose is to provide an overview of the dynamics of integrated knowledge network models and processes as well as the dynamics of cooperatives and their respective models. The literature review evaluates the best practice between integrated knowledge network and cooperative models. It also defines the tools and concepts required for the framework and in particular focuses on cooperatives in South Africa.

5.2. KNOWLEDGE MANAGEMENT

5.2.1. DEFINING KNOWLEDGE AND INTELLECTUAL CAPITAL

The definition of knowledge is a continuously debated topic among philosophers in the field of epistemology (Schutte, 2010) with several definitions and theories attempting to explain its existence. While the classical definition of knowledge of the well-known philosopher Plato[82], is that knowledge is comprised of fulfilment of the principles that are *"justified, true and believed"*.

However, all do not ultimately endorse Plato's definition as for example it neglects to take into account Gettier's problem[83]. Another criticism is that it neglects humanistic components of knowledge (Nonaka, et al., 2001). To summarise the definition of knowledge, refer to Table 5.1 below for a list of dictionary definitions.

Table 5.1: List of Dictionary Definitions of Knowledge

Dictionary	Definition of Knowledge
Oxford English Dictionary	*"Facts, information, and skills acquired through experience or education; the theoretical or practical understanding of the subject."*
Cambridge English Dictionary	*"Understanding of or information about a subject that you get by experience or study, either known by one person or by people generally."*
Online Business Dictionary[84]	*Legal Context: Law: "Awareness or understanding of a circumstance or fact, gained through association or experience."* *Organisational context: "Knowledge is the sum of what is known and resides in the intelligence and the competence of people."*

In the context of this research thesis, only the organisational context where knowledge plays a vital role will be considered. When considering the organisational context, knowledge has gradually increased in value as it is regarded in its own right to be a factor of production called knowledge or also known as intellectual capital. To summarise the definition of the knowledge/intellectual capital, refer to Table 5.2 below for a list of dictionary definitions.

In literature and practice, knowledge and intellectual capital are used interchangeably, but there can be a fundamental difference between knowledge and intellectual capital. This is that knowledge capital can be seen as a person 'applying knowledge' while intellectual capital can be seen as 'creating knowledge'. Using a metaphor, knowledge can conceptually be described as gunpowder while intellectual capital is the ammunition, and structural capital is the weapons system (Nguyen, 2006). This once again illustrates the value between

[82] *Plato, Greek philosopher and mathematician, dialogue regarding the nature of knowledge as discussed by Socrates and Theaetetus (circa 369 BC).*
[83] Gettier (1963).
[84] Business Dictionary, 2014. *Definition of Knowledge*. [Online] Available at http://www.businessdictionary.com/definition/knowledge.html [Accessed on 12 August 2014].

having an idea, invention and execution. Ideas are worthless unless commercialised, while inventions are stepped down the line from just an idea, but if not taken to market, can be detrimental to the organisation.

Table 5.2: List of Dictionary and Literature Definitions of Knowledge/Intellectual Capital adapted from Marr et al. (2004, p. 554)

Dictionaries/Literatures	Definition of Knowledge/Intellectual Capital
Oxford Dictionary[85]	*"A complex concept that includes human knowledge, information systems, brand names, and reputation."*
Online Investopedia Dictionary[86]	*"An intangible asset that comprises the information and skills of the company's employees, their experience with business processes, group work and on-the-job learning. Knowledge capital is not like the physical factors of production (land, labour and capital) in that it is based on skills that employees share with each other in order to improve efficiencies, rather than on physical items. Having employees with skills and access to knowledge capital puts a company at a comparative advantage to its competitors."*
Online Business Dictionary[87]	*"Know how that results from the experience, information, knowledge, learning, and skills of the employees of an organisation. Of all the factors of production, knowledge capital creates the longest lasting competitive advantage. It may consist entirely of technical information (as in chemical and electronics industries) or may reside in the actual experience or skills acquired by the individuals (as in construction and steel industries). Knowledge capital is an essential component of human capital."*
Hall (1992)	*Intellectual capital is either classified as 'assets' which refers to brand identity, trademarks, patents, etc. or as 'skills' which refers to know-how, organisational culture, etc. (tacit knowledge).*
Brooking (1996)	*Intellectual capital consists out of four components, namely, human-centred assets, infrastructure assets, intellectual property assets, and market assets.*
Sveiby (1997)	*Intangible assets consist out of three components, namely, (1) external structure, (2) intangible assets and (3) human competence.*
Roos *et al.* (1997)	*Intellectual capital consists out of human capital ('thinking part') and structural capital ('non-thinking part').*
Edvinsson & Malone (1997)	*Intellectual capital is comprised out of human and structural capital which involves applied experience, customer relationships, organisational technology and professional skills that supply the organisation with a competitive advantage.*
Lev (2001)	*Intellectual capital is regarded as a source of future value that is generated through human resource practices, innovation and organisation design.*
Marr & Schiuma (2001)	*Intellectual capital is comprised out of all knowledge-based assets, which are characterised between infrastructure (both physical and virtual), and organisational actors.*

[85] Oxford Dictionary of Business and Management, 2009. [Online] Available at http://www.oxfordreference.com/view/10.1093/acref/9780199234899.001.0001/acref-9780199234899-e-3333 [Accessed on 12 August 2014].
[86] Investopedia, 2014. Definition of Knowledge Capital. [Online] Available at http://www.investopedia.com/terms/k/knowledge-capital.asp [Accessed on 12 August 2014].
[87] Business Dictionary, 2014. Definition of Knowledge Capital. [Online] Available at http://www.businessdictionary.com/definition/knowledge-capital.html [Accessed on 12 August 2014].

5.2.1.1. TYPES OF INTELLECTUAL CAPITAL

In a comprehensive, systematic literature review by Marr et al. (2004), four key models were identified in measuring knowledge assets, which are as follows:

- The Skandia Navigator developed by Edvinsson and Malone (1998),
- The Intellectual Capital (IC)-Index developed by Roos *et al.* (1997),
- The IC Audit Model developed by Brooking (1996), and
- The Intangible Asset Monitor developed by Sveiby (1997).

In these models, a deeper understanding of intellectual capital (IC) can be gained, but for the purpose of this research, the Skandia's classification of market value (Edvinsson & Malone, 1998) and IC's distinction tree (Roos, et al., 1997) will be considered as supporting material in describing the value of intellectual capital.

Skandia's classification of market value is illustrated in Figure 5.2 below is used to evaluate its market value through dividing its classification system into financial capital and intellectual capital. Here IC is subdivided into human capital and structural capital that consists of other intangible assets regarded as embedded in the organisation (Marr, et al., 2004). This is further subdivided into customer capital, for example consisting of customer relationship value and organisational capital. The latter is further subdivided into process and innovation capital, whereby process capital relates to the procedures, routines and policies governing the internal processes of the organisations, while innovation capital relates to the enabling components creating new innovative products and processes.

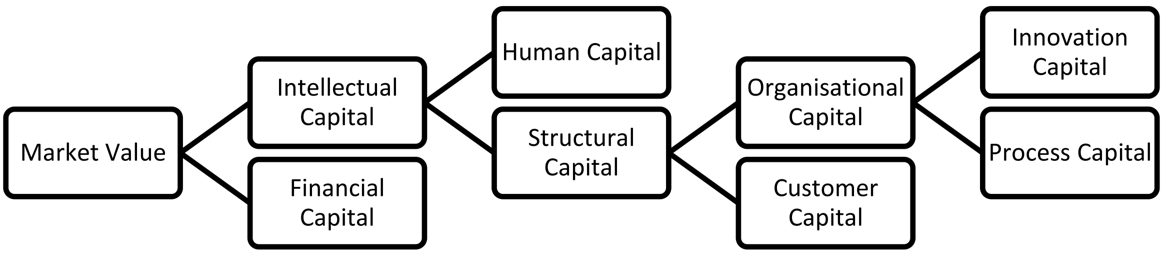


Figure 5.2: Skandia's Classification of Market Value adapted from Edvinsson & Malone (1998)

The Skandia's Navigator is based on the above-mentioned classification scheme and proposes an intellectual capital assessment tool with five key measurements, namely, financial focus, customer focus, process focus, human focus, and innovation focus (renewal & development). This is illustrated in Figure 5.3 below, whereby each of these focal points relates to critical success factors that quantify change measures (Marti & do Rosario Cabrita, 2012). These focal points are defined as follows:

- ***Financial focus*** concentrates on the past financial output that is captured from the activities of an organisation. This primarily represented in monetary indicators.

- ***Customer focus*** concentrates on evaluating the value of customer capital that uses present monetary and nonmonetary indicators. Here customer intellectual capital measurements should effectively evaluate the organisation's customer relations. Brand identity is another criterion that could form part of customer focus.
- ***Human focus*** concentrates on the measuring of the human capital within the organisation. Key measures that external stakeholders' desire is the contributions that human capital has in creating value for the organisation and how the organisation's culture supports and contributes to the strategic initiatives and goals set by the organisation. Present monetary and nonmonetary indicators can measure this.
- ***Process focus*** concentrates on the effective support processes and technologies that enable the organisation's value creation. This is measured as the value of the assets and effectiveness of the assets that use both present monetary and nonmonetary indicators.
- ***Innovation focus*** concentrates on the attempt to create innovation. Present and future monetary and nonmonetary indicators can measure this for the effectiveness of investments such as training programmes and R&D. It also includes the evaluation of strategic partners' expenditures.

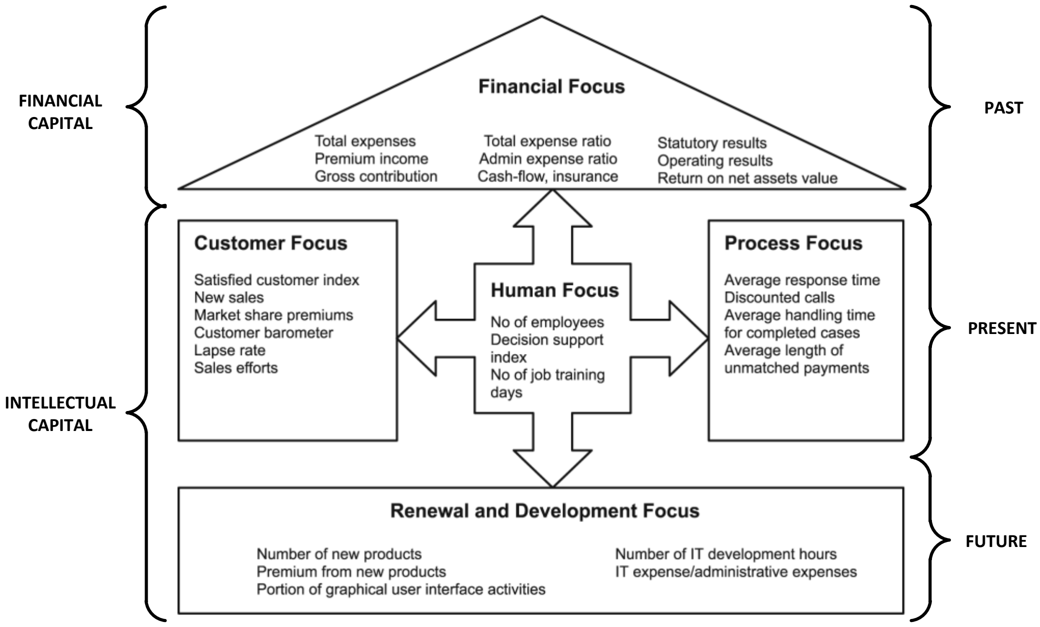


Figure 5.3: Skandia Navigator Model adapted from Edvinsson & Malone (1998) and Marti & do Rosario Cabrita (2012)

In summary, the Skandia Navigator uses 164 different indicators, which are made up of 91 IC indicators, and 73 traditional indicators measuring the five focus areas whereby monetary and nonmonetary indicators are combined (Marti & do Rosario Cabrita, 2012). However, Marr et al. (2004) argue that the measurement indicators are all eventually expressed in monetary terms with a lack of relation between focus areas. They also suggest similarities to the Balanced Scorecard[88] approach but argue its superiority in expressing focus areas

[88] The *Balanced Scoredcard model* by Kaplan (1988) is a strategic management tool for measuring an organisation's innovation (Tidd & Bessant, 2011, p.76). It is discussed at length in Kaplan & Norton (1996), Adams *et al.* (2006) and Hayes (2010, p.430-433).

relationships. Nonetheless, both can be regarded as sufficient methods in evaluating the organisation's intellectual capital.

The other method, being the IC's distinction tree is illustrated in Figure 5.4 below and attempts to holistically consolidate all the IC indicators into a singular index to provide a comprehensive visualisation of the organisation's IC ability (Marr, et al., 2004). Similar to the above, IC is subdivided into human ('thinking knowledge assets') and structural ('non-thinking knowledge assets') capital, this means that knowledge embedded in employees is separated from structural knowledge assets.

Human capital is then further subdivided into competence, attitude and intellectual property. Competence capital refers to education and skills while attitude capital refers to employees' behavioural aspects, and intellectual property capital refers to the employees' innovation capabilities.

While structural capital is further subdivided into relationship, organisation, and renewal and development capital. Relationship capital refers to the aggregation of undertaken customer-, supplier-, ally- and shareholder relationships. Organisation capital refers to all components of the organisation such as databases, processes, manuals, policies, culture and management styles. Finally, renewal & development capital refers to the intangible assets that can create future value for the organisation, for example, employee training programmes, organisation restructuring and reengineering, and R&D.

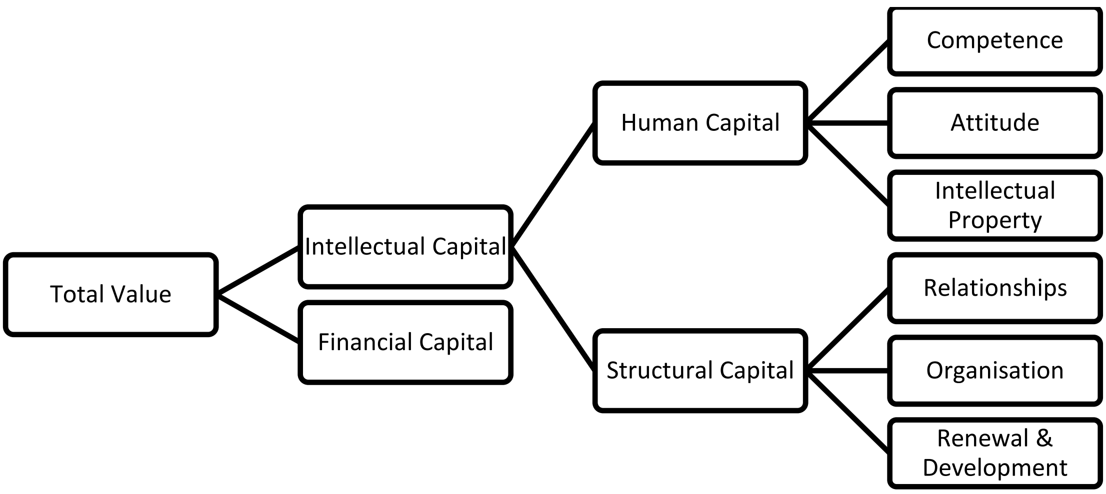


Figure 5.4: IC Distinction Tree adapted from Roos *et al*. (1997)

The IC index is then calculated using the above-mentioned classification scheme as a dimensionless number with three adjustment factors that alter the outcome of IC index by taking into consideration the particular industry the organisation operates under and the importance of the organisation structure.

Taking into consideration the above-mentioned classification schemes of intellectual capital, there is no widely accepted definition of IC and a deeper underlining understanding of it is required (do Rosário Cabrita & Vaz , 2005). Through revising the literature on intellectual capital types, its definition is generally explained as follows:

- ***Intellectual Capital*** can essentially be related to the value created through converting knowledge (Edvinsson & Sullivan, 1996, p. 361). This relates to three elements forming the foundation of IC's definition, namely, *(i) intangibility*, *(ii) value-creating knowledge*, and *(iii) collective practice effect* (do Rosário Cabrita & Vaz , 2005). With numerous IC classification schemes in the literature, the general taxonomy emerged as:

- ***Human capital*** is the most important component of IC as the major source of intangible value comes from human interaction (do Rosário Cabrita & Vaz , 2005). Human capital is further an individual perspective defined by four components, namely, attitude, education, experience and genetic inheritance (Hudson, 1993). From an organisational perspective, human capital is regarded as the source of innovation and strategic regeneration (Bontis, 1998) which Roos *et al.* (1997) suggest competence, attitude and intellectual property as the core components. While from a macroeconomics perspective, national economic activity, competitiveness and prosperity are driven by human capital (OECD, 1996).
- ***Structural capital*** is the capability of the organisation to achieve the organisation's goals faced with both internal and external challenges. The organisation's capabilities include aspects such as information systems, infrastructure, procedures, organisational culture and routines. This is the structure whereby knowledge is retained, packaged and transferred (do Rosário Cabrita & Vaz , 2005).
- ***Relational capital*** is the embedded knowledge within all the stakeholders able to influence the organisation. This can be measured through a function of longevity (Bontis, 2002, p. 13), marketing (Håkansson & Snehota, 1995) and customer relationship (Gibbert, et al., 2001), which can be seen as a source of competitive advantage. Here employee commitment, motivation and satisfaction can contribute to the effectiveness of the organisation which positively influences customer loyalty (Kaplan & Norton, 1996).

5.2.1.2. TYPES OF KNOWLEDGE

It is also important to understand that different types of knowledge exist, which is an essential part of managing knowledge. However, there have been numerous attempts in classifying knowledge and its different dimensions (Frost, 2014). Polanyi (1998) produced a well-endorsed thinking surrounding tacit knowledge being the creative acts, especially acts leading to new discoveries, which are strongly associated with personal human feelings and commitments. In mapping the knowledge landscape, Nonaka & Takeuchi (1995), and Nonaka *et al.* (2001), reformatted and categorised the work of Polanyi (1998) between explicit and tacit knowledge as illustrated in Figure 5.5 below.

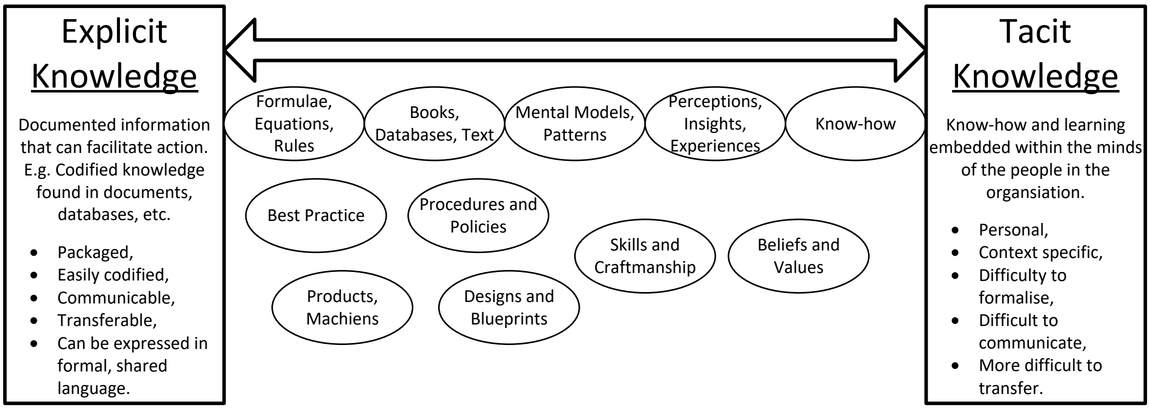


Figure 5.5: Knowledge Mapping between Explicit and Tacit Knowledge adapted from Schutte (2010) and Frost (2014)

Explicit knowledge is often referred to as the 'know-what' (Brown & Duguid, 1991) which is defined as a type of knowledge that is explicitly and consciously held in the individual's mental focus (Schutte, 2010). This can easily be formalised and codified into words and numbers that can be communicated and shared through data, equations, specifications, etc.

The greatest challenge of explicit knowledge, similarly to that of information, is to ensure from a management perspective that the important knowledge is stored, updated, and that employees have access to it (Frost, 2014). This is why numerous academics consider explicit knowledge as less important as it lacks sophistication in experience and know-how to bring about competitive advantage to the organisation (Brown & Duguid 1991, Bukowitz & Williams 1999). For example, this is where various IT-driven knowledge management systems tend to lose the plot as they are merely managing software of information and/or explicit knowledge.

Tacit knowledge is often referred to the know-how and was originally defined by Polanyi, which is strongly associated to personal human feelings and commitments. Nonaka *et al.* (2001) argue its deep root in action, commitment and involvement. Brown & Duguid (1991) define it as intuitive and experience-based knowledge that is hard to communicate and to define, but nonetheless Wellman (2009) argue that this valuable knowledge type will most likely lead to innovation breakthroughs. The extent of the value of tacit knowledge is directly linked to the lack thereof which reduces an organisation's capability to innovate and sustain its competitive advantage (Gamble & Blackwell, 2001).

This sophistication and complexity surrounding the nature of tacit knowledge is exactly where its greatest challenge lies, especially in knowledge management and IT systems. Frost (2014) argues that codification of tacit knowledge creates this difficulty as the tacit knowledge is most likely embedded in the tacit knowledge holder. For example, virtually all IT practitioners will find it very difficult to convey their intuitive experience codified into a document that a beginner would be able to translate as their know-how. This is why IT systems and the knowledge management field must have a very strong emphasis on the tacit dimension (Frost, 2014), especially the needs developed by the end user. Other aspects complicating tacit knowledge are that it is rooted in the human stakeholders' minds and therefore must include their attitudes, cultural beliefs, values, etc. while also considering their capabilities, expertise and skills (Botha, et al., 2008).

In the research by Newman & Conrad (2000), another knowledge type is defined, called implicit knowledge as they defined three different types, namely explicit, implicit and tacit knowledge, which is defined as follows:

- ***Explicit knowledge*** consists out of 'knowledge artefacts' that are directly and entirely inter-transferable between people as the 'artefacts' are able to be codified into understandable human senses (e.g. books, databases and reports)
- ***Implicit knowledge*** consists of 'knowledge artefacts' that are not explicitly captured, but rather in effect indirectly captured as the codification process is uncompleted. This relies on the interpretation of the content whereby reminisced knowledge is used to capture the implicit knowledge.
- ***Tacit knowledge*** as mentioned above, it is the know-how that comes from intuition and experience, making it the insidious yet most powerful form of knowledge. In essence, as Polanyi referred to tacit knowledge as being knowing more than what we can say about it (Schutte, 2010).

Tidd & Bessant (2011) argue that the distinction between tacit, implicit and explicit knowledge is based on the ease at which knowledge is expressed, rather than on the complexity or difficulty of the knowledge itself. Blackler (1995) defined a finer knowledge typology, whereby the five knowledge types are as follows:

- ***Embrained knowledge*** consists of the conceptual skills and intellectual abilities, which emphasise the significance of abstract knowledge creation.
- ***Embodied knowledge*** consists of knowledge created from an action orientation (practice or experience) which can be developed unnoticed over an extended period of time and is only partly explicit knowledge (Horvath, 2000). This form of know-how also occurs in most organisations, residing in groups, teams and/or communities (Gamble & Blackwell, 2001).
- ***Encultured knowledge*** consists of the process where the shared knowledge's meaning and understanding are achieved in the organisation. This involves socialisation and accumulation (Tidd & Bessant, 2011).
- ***Embedded knowledge*** consists of the knowledge that resides in systematic processes and routines. This type of knowledge is 'embedded' either formally through a formalised intentional initiative (a new beneficial routine by management), or informally through the use and application of the other knowledge types by an organisation as an example (Gamble & Blackwell, 2001). An important aspect to note about embedded knowledge is that the knowledge can be created in explicit sources, but cannot itself be explicit, which means that knowledge can be developed subconsciously in explicit and/or implicit sources of an organisation (Horvath, 2000).
- ***Encoded knowledge*** consists of knowledge represented by signs, symbols and images, which include blueprints, designs, electronic media and manuals.

Horvath (2000) and Gamble & Blackwell (2001) also argued that embodied and embedded knowledge form part of tacit knowledge while Tidd & Bessant (2011) suggested a possible sixth knowledge type, commodified knowledge that consists of the knowledge embodied into the organisation's outputs. For example, the products and/or services created by the organisation in itself are a knowledge type whereby the organisation can learn. The key importance of these knowledge types is that none is inherently superior to another as the relevant knowledge type will be contingent on the needs of the organisation. It is also important to note that knowledge management is not only reserved to knowledge creation as an input, but also as an output as the organisation achieves its goals that represent a continuous learning organisation.

Typically, IT systems play a vital role in the manner in which these knowledge types are implemented. The difficulty is in effectively managing these IT and knowledge management systems as they can easily be beneficial to the one type, but detrimental to the other. The most difficult to effectively manage is embedded knowledge as it subsequently affects the entire culture of the organisation and if successfully implemented provides a significant competitive advantage (Frost, 2014).

Bornemann et al. (2003) adds additional dimensions to the definition of knowledge which further articulate the above-mentioned knowledge types in a knowledge categorisation guide. Here the categorisation of knowledge is divided into three dimensions as illustrated in Figure 5.6 below and defined as follows:

- **Knowledge Psychology:**
    - ***Declarative knowledge*** is defined as facts (issues, processes, etc.) and objects (persons, things, etc.). It is also described as the knowledge of 'knowing something' or the 'know what'.
    - ***Procedural knowledge*** is defined as the performance manner of cognitive actions and processes. It is also described as the knowledge of the process or the '*know-how'*.
- **Knowledge Holder:**
    - ***Individual knowledge*** is the knowledge held by the individual that they control and is not subsequently dependent on the specific context.
    - ***Collective knowledge*** is the shared knowledge of specific relevant environment (organisation, cluster, etc.) which includes the individual's knowledge and the shared knowledge that collectively fulfils its potential.
- **Articulability:**
    - ***Explicit knowledge*** is defined as the knowledge that is easily understood and can be articulated. It can be regarded as the knowledge of the 'knower'. Also, look at implicit knowledge discussed above.
    - ***Tacit knowledge*** is defined as the knowledge that the knowledge holder is not necessarily aware of. Also, look at embedded and embodied knowledge discussed above.

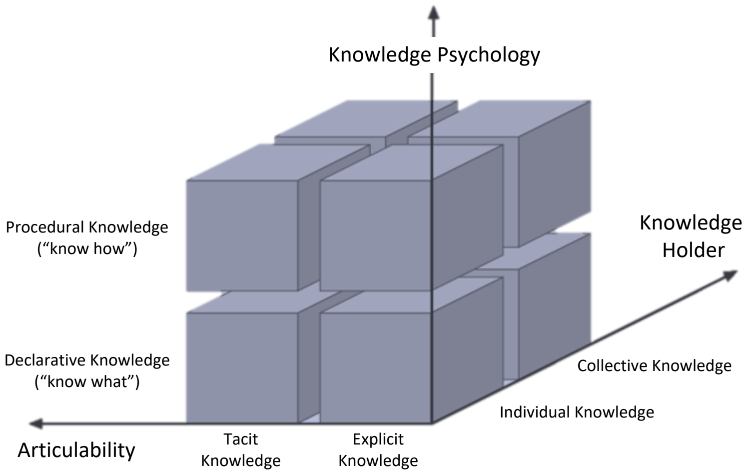


Figure 5.6: Types of Knowledge Categorised adapted from (Bornemann, et al., 2003) and (Schutte, 2010)

In this research thesis, the discussion does not intend to further the definition or understanding of knowledge or types of knowledge, but will aim to understand the dynamics of implementation of knowledge management systems.

5.2.2. DEFINING KNOWLEDGE MANAGEMENT

Knowledge management is a discipline that emerged in the early 1900s, but only recently has there been a spike in interest and publications (Wilson, 2002) with a particular focus on the management of the organisation while specifically focusing on 'knowledge' (Bornemann, et al., 2003). However, knowledge management is not only in one specific field of managing knowledge flow within an organisation. In Table 6 below, the different schools of knowledge management are mentioned that come up in the literature (Earl, 2001).

Knowledge management will, therefore, have a different definition in respective fields. For the purpose of this research study, knowledge management will specifically look at the behavioural school whereby knowledge management concerning the organisation, spatial and strategic attributes will be discussed. In the section above, the school of economics perspective of knowledge as a commercial attribute was defined and will be considered for the purpose of this research.

Table 5.3: Literature Schools of Knowledge Management adopted from Earl (2001)

Schools	Technocratic			Economic	Behavioural		
Attribute	Systems	Carto-graphic	Engineer-ing	Commer-cial	Organisa-tional	Spatial	Strategic
Focus	Technology	Maps	Processes	Income	Networks	Space	Mindset
Aim	Knowledge Base	Knowledge Directions	Knowledge Flows	Knowledge Assets	Knowledge Pooling	Knowledge Exchange	Knowledge Capabilities
Unit	Domain	Enterprise	Activity	Know-how	Communi-ties	Place	Business
Example	*Xerox* *Shirko Firms*	*Bain & Co* *AT&T*	*HP* *Frito-Lay*	*Dow Chemical* *IBM*	*BP Amoco* *Shell*	*Skandia* *British Airways*	*Skandia* *Unilever*
Critical Success Factors	Content Validation Incentives to Provide Content	Culture/ Incentives to share Knowledge Networks to Connect People	Knowledge Learning and Information Unrestricted Distribution	Specialist Teams Institution-alised Process	Sociable Culture Knowledge Intermediari es	Design for Purpose Encouragem ent	Rhetoric Artefacts
Principal IT Contribu-tion	Knowledge-based Systems	Profiles and Directories on Internets	Shared Databases (Cloud-based)	Intellectual Asset Register and Processing System	Groupware and Intranets	Access and Representat ion Tools	Eclectic
Philosophy	Codifica-tion	Connectivity	Capability	Commer-cialisation	Collabora-tion	Cont-activity	Conscious-ness

When considering the behavioural school of knowledge management, the following will be simplistically explained for ease of understanding. As knowledge management as a discipline started to reach maturity in literature, there is increasing thought on the theory and practice of knowledge management. The simplistic understanding of knowledge management is based on three core levels that are defined as follows and are illustrated in Figure 5.7 below:

- ***Data level*** is comprised of all the documentable knowledge available, for example, databases and media.
- ***Knowledge level*** is comprised of the interaction between organisational members that transfer, create and share knowledge among fellow members.
- ***Action level*** is the organisation value creation processes whereby the inputs are from the data and knowledge level.

These core levels are then further linked to five core knowledge processes between the technical and social subsystems. The five core knowledge processes are application, communication, documentation, information and learning.

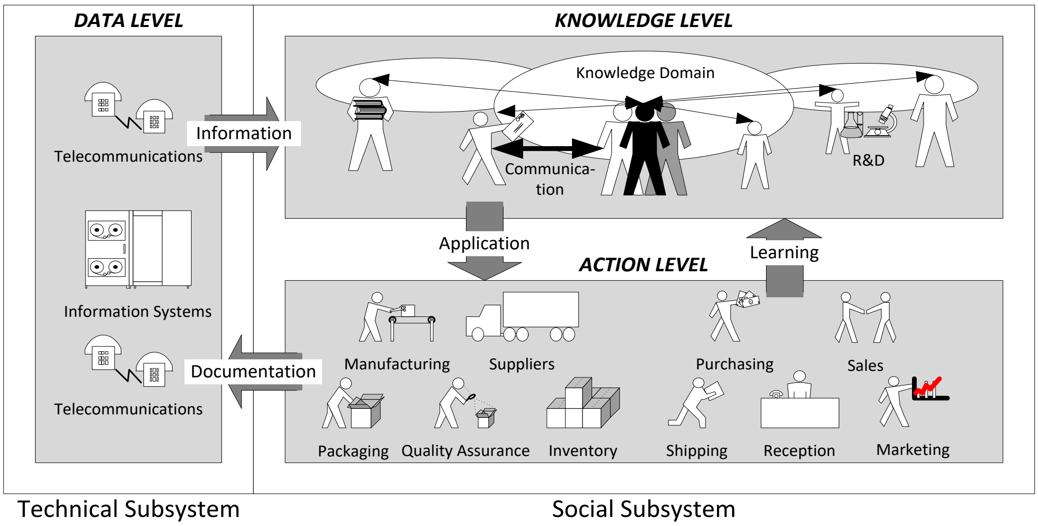


Figure 5.7: Simplistic Knowledge Management Model for Organisations adapted from (Bornemann, et al., 2003)

5.2.2.1. KNOWLEDGE MANAGEMENT IMPLEMENTATION CONSIDERATIONS

When implementing any knowledge management system, it is important to understand the processes between the technical and social subsystems, as well as the core knowledge processes, which are illustrated in Figure 5.7 above. Notable is the misperception that exists in the industry concerning the implementation of knowledge management systems that they consist exclusively of information technology hardware and software solutions. *So what is the difference between information management and knowledge management?* The differences are tabulated in Table 5.8 below.

Key to the understanding of the difference between information and knowledge management is that knowledge management builds onto information management. Zeleny (1987) and Ackoff (1989) describe this as follows (Rowley, 2007):

- **Data** is the *'know-nothing'* and can be seen as symbols/signals;
- **Information** is the *'know-who'* and is data that is processed to be useful;
- **Knowledge** is the *'know-how'* and is the application of data and information;
- **Understanding** is the appreciation of the *'know-how';*
- **Wisdom** is the *'know-why'* and is an evaluation of understanding;
- **Enlightenment** is the attainment of the truth that enables the sense between right and wrong, and allows for social acceptance, approval and respect.

Table 5.4: The Differences between Information and Knowledge Management constructed from Terra & Angeloni (2002) and Frost (2013)

Components	Information Management	Knowledge Management
Main Fields of Discipline	*Interdisciplinary fields of library-, information- and computer sciences.*	*Interdisciplinary field of business administration social-, library-, information- and computer sciences.*
Focus of Field	*Data and information.*	*Knowledge, experience, understanding and wisdom.*

Aim of Field	*Managing of unstructured and structured data and information.*	*Managing of uncodified and codified knowledge.*
Definition	*Organising, analysing and retrieving of relevant and purposeful endowed data.*	*Managing of the process of locating, capturing and utilising knowledge, transferring & sharing knowledge and the creation of new knowledge within an organisation.*[89]

Another fittingly summarised illustration for understanding the differences between information and knowledge management is shown in Figure 5.8 below. Building on the definitions of the wisdom hierarchy by Zeleny and Ackoff mentioned above, a conglomerate of different wisdom hierarchy models was constructed. These models included the work by Awad & Ghaziri (2004), Chaffey & Wood (2005), Choo (2006), and Rowley (2007).

Awad & Ghaziri described how data and information are algorithmic and programmable, but become more difficult to translate into algorithms and programs as knowledge and wisdom are created. Chaffey & Wood describes how meaning and value are created in the transformation process. Choo argued two different dimensions of organisational structure and human agency/activity that are differently affected in the transformation process. Then lastly, Rowley (2007) suggested possible applicable systems for the transformation process.

Together these models give a good overview and understanding of the different aspects between information and knowledge management that is fundamental to understanding the implementation considerations that are required for successful knowledge management systems. However, success and failure are inextricably related to the expectations of each individual information and knowledge management system. This degree of expectation is also related to the associated ability and degree of integration of the system. These aspects are further discussed below as barriers to implementation and types of failures.

[89] *This process and definition of knowledge management is formulated from the combination of two models by Newman & Conrad (2000) and Back et al. (2005) which was described in the dissertation by Schutte (2010).*

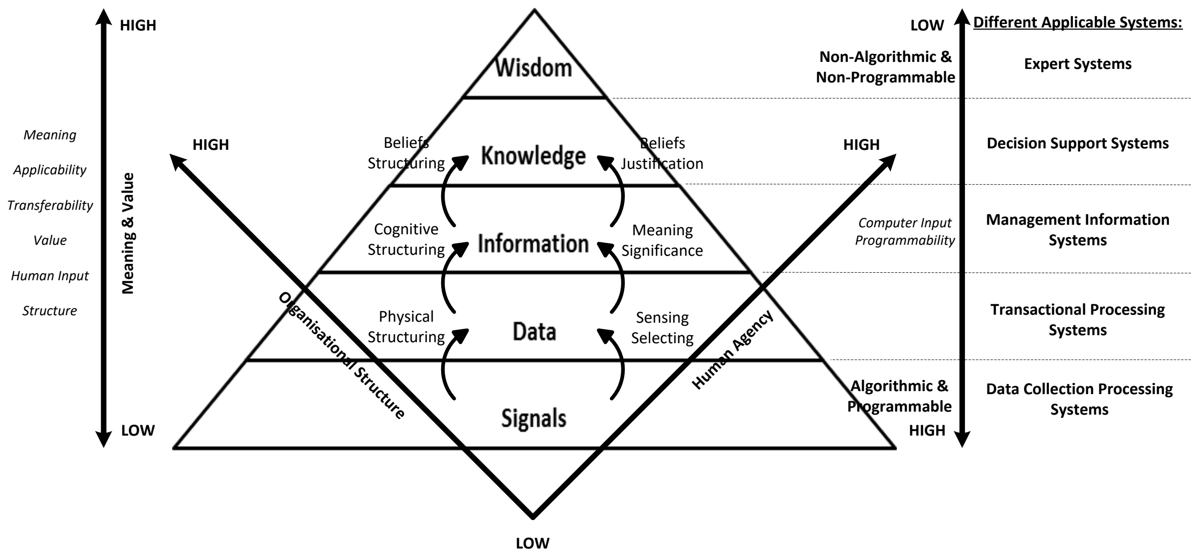


Figure 5.8: Conglomeration of Wisdom Hierarchy Models Constructed from Awad & Ghaziri (2004), Chaffey & Wood (2005), Choo (2006), and Rowley (2007)

The respective barriers to implementation of knowledge management systems is also fittingly summarised in the research on performance measurements for communities of practices by Raimann *et al*. (2000). They found that communities are naturally complex, but there are both internal and external enabling conditions within which the performance of knowledge networks can be improved. This being said, if these conditions are not present or sufficiently satisfying, they can be deemed as barriers to the implementation and performance of knowledge network and management systems (Schutte, 2010). These barriers are illustrated in Figure 5.9 below.

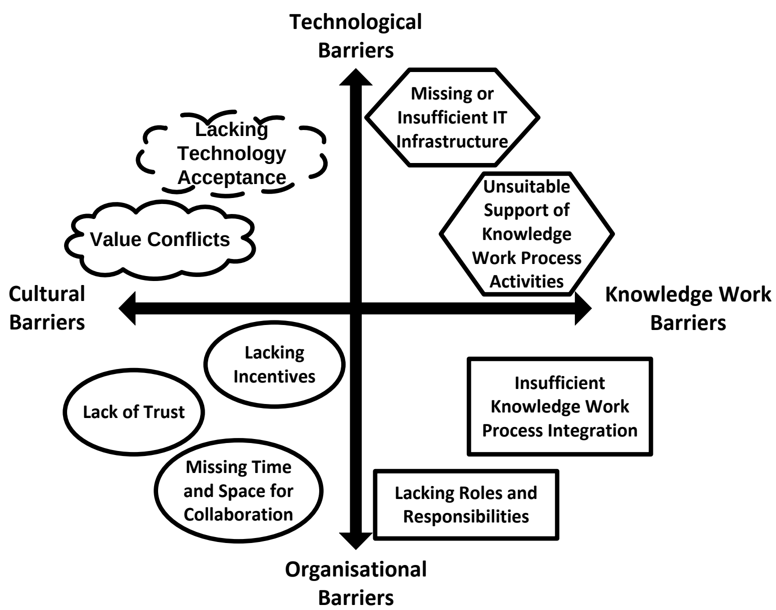


Figure 5.9: Knowledge Network and Management Systems Implementation Barriers adapted from Raimann *et al.* (2000) and Schutte (2010)

In the work by Frost (2013), the barrier factors contributing to the implementation failures of knowledge management systems can further be divided into two groups, the causal failure factors and the resultant failure factors. The causal failure factors are defined as unsuitable conditions for knowledge management systems resulting from fundamental barriers and problems within the organisation, while the resultant failure factors relate to the symptoms of causal failure factors. These groups of factors are combined and listed in Table 5.5 below, and it is important to note that there is no direct relationship between any corresponding singular causal and resultant factor.

Table 5.5: Barrier Factors Contributing to the Implementation Failures of Knowledge Management Systems adapted from Frost (2013)

Causal Failure Factors:	Resultant Failure Factors:
• **Insufficient measurable benefits and performance indicators,** • **Insufficient support from management for the implementation of the system,** • **Improper planning, designing, coordinating, and evaluating the system,** • **Inadequate level of skills from management and administrators of the system,** • **Lack of acceptance and support in the organisational culture, and** • **Inadequate system or organisational structure support for the system.**	• Lack of extensive contribution, • Insufficient applicability, quality, and utility of the system, • System is overemphasising determinant requirements, formal learning and, systematisation, • Improper technology infrastructure implementation, • Improper management of implementation budget and operation costs, • Lack of ownership and responsibility, and • Staff leaving causing knowledge loss.

On the other hand, most of these barrier factors contributing to the failure of numerous knowledge management systems can be translated into key success factors contributing to the success of the system. In identifying the critical success factors for knowledge management systems, a collective synthesis from literature is provided in Table 5.6 below. For the purpose of this research study, an overview of critical success factors for knowledge network is required. Since the list in Table 5.6 specifically focuses on knowledge management systems within an organisation, a more macro perspective will provide insight into knowledge networks among individuals, organisations and communities. These critical success factors for knowledge networks were investigated by the Forfás (2004) industry department in Europe and are as follows:

- ***Identified Need(s) and Requirement(s):*** There must be fundamentally clear and identified need(s) and/or requirement(s) for implementing a knowledge network system that will benefit the individuals and the organisations. This will act as a sense of belonging and motivation in achieving its purpose.
- ***System Purpose and Objectives:*** This relates to the above-mentioned need and requirement for the system, as the purpose and its subsequent objectives are there to primarily reflect and achieve the identified need(s) and/or requirement(s) of the organisation(s) and its members.
- ***Leadership, Management and Vision:*** The likelihood to succeed increases with the articulation of a clear vision and concise goals by network leaders and management. Even more important than articulating the short and long-term goals is the implementation of the goals in a realistic action plan. This is where the support from management and commitment from the leaders should flourish.

- ***Initial Successes and Social Interaction:*** The importance of early success is vital to gain initial support as it shows members an immediate or short-term return on their investment. This also contributes to the loyalty of members to continue their involvement in the network and ensures member retention. It is, therefore, important to structure the networks objectives and work programme to gain initial success and acceptance. This is also why social interaction should not be overlooked.
- ***Degree of Trust:*** In the implementation of knowledge networks, members and organisations are required to develop a certain degree of trust between and among themselves. For successful implementation, a reliant degree of trust is to be established on and within the network. This becomes especially difficult when members within the network are market competitors.
- ***Ownership and Responsibility:*** The leaders and management of the network will be required to take ownership and responsibility of their roles to implementing the process and drive the network towards its vision and goals. This is especially important to establish commitment and trust between and among leaders and management, as well as members and organisations within the network.
- ***Time:*** The implementation and development of durable networks takes time. The degree of trust and confidence between and among members and organisations requires a considerable period before commitment is established. This is why initial success and taking ownership and responsibility are also vitally important. A solution to establishing commitment is through establishing social interaction between member organisations.
- ***Critical Mass:*** It is important to develop a critical mass over time to produce a successfully implemented network, but a lack of critical mass often delays the outcome of the network and it achieving its vision.
- ***Key Player(s) and Roles:*** It is important to establish the key player(s) and the respective roles as aligned with the network’s vision. This is to ensure that the key player(s) can influentially drive the network outputs towards the desired vision and to achieve its critical mass.
- ***Communication/Branding:*** In the process of developing the network and reaching its vision, a clear brand identity needs to be developed for the network that enables clear communication and representation of the network to all its members. This will also enable a quicker commitment of members as critical mass starts to gain momentum, which creates longevity.
- ***Facilitation:*** It is important that networks provide continuous support and on-going facilitation for the success of the network. The inputs of the network management are to support the network, broker and individual members' needs, coordinate complex processes and implement the work programme of the network to ensure longevity of the network.
- ***Top-Down Incentives:*** Incentives are very helpful for promoting activity in the development process.
- ***Process:*** Networks are operationally challenging and complex, making the process or the 'how to operate' essential to success.

Table 5.6: Literature Synthesis of Critical Success Factors for Knowledge Management Systems adapted from Wong (2005)

General Factors	Skyrme & Amidon (1997)	Davenport *et al.* (1998)	Liebowitz (1999)	APQC (1999)	Holsapple & Joshi (2000)	Hasanali (2002)	Wong (2005)	Akhavan *et al.* (2006)
Culture	A knowledge creation and sharing culture	Knowledge-friendly culture	Supportive culture	Culture	-	Culture	Culture	Organisation culture and knowledge sharing
Leadership & Management	Knowledge leadership	Senior management support	Senior leadership support	Leadership	Leadership	Leadership	Management leadership and support	CEO support and commitment
Incentive & Recognition	-	Change in motivational practices	Incentives to encourage knowledge sharing	-	-	-	Motivational aids	-
Measurement	-	Link to economic performance or Industry value	-	Measurement	Measurement	Measurement	Measurement	Knowledge audit
Processes	Systematic organisational knowledge processes	Multiple channels for Knowledge transfer	-	-	Control coordination	-	Processes and activities	Business process engineering
Roles & Responsibilities	-	Organisation infrastructure	A CKO or equivalent and a KM infrastructure	-	-	Structure, roles and responsibilities	Organisation infrastructure	Networks of experts
Strategy	Strong link to a business imperative. A compelling vision and architecture	Clear purpose and language	A KM strategy	Strategy	-	-	Strategy and purpose	Knowledge strategy
Technology	A well-developed technology infrastructure	Technical infrastructure. Standard and flexible knowledge structure	Knowledge ontologies and repositories KM systems and tools	Technology	-	IT infrastructure	IT	Knowledge storage. Knowledge architecture
Other	-	-	-	-	Resources	-	Resources. Training and education. Human resource management	Training programmes. Pilot.

5.2.2.2. KNOWLEDGE MANAGEMENT FRAMEWORKS, MODELS & SYSTEMS

In the literature there are numerous knowledge management frameworks, models and systems that are more sophisticated than the simplified knowledge management model that is illustrated in Figure 5.7 above. Models that are more sophisticated would generally include more detail about other core components, such as people, processes, technology, organisation culture, and/or organisation structure, depending on the specific model. Other examples would include different perspectives such as complexity science (Snowden, 1997), community of practice (Kim, et al., 2003), constructivism (Wyssusek, et al., 2001), information theory (McInerney, 2002), intellectual capital (Bontis & Choo, 2002), and even social network analysis (Groth, 2003).

For this reason, twelve knowledge management frameworks, models and systems were chosen that are regarded as relevant to this research and will be discussed in more detail as follows:

- **(1)** Knowledge categories and transformation process model by Hedlund & Nonaka (1993),
- **(2)** Knowledge network spiral model by Nonaka & Takeuchi (1995),
- **(3)** Knowledge management process framework by Bukowitz & Williams (1999),
- **(4)** General knowledge model by Newman & Conrad (2000),
- **(5)** Organisational knowledge creation SECI model by Nonaka *et al.* (2001),
- **(6)** Knowledge management matrix by Gamble & Blackwell (2001),
- **(7)** Knowledge-based network organisation model by Bornemann *et al.* (2003),
- **(8)** Knowledge creation and application of projects framework by Bornemann *et al.* (2003),
- **(9)** Centralised knowledge management system by Maier (2004),
- **(10)** Knowledge management process model by Botha *et al*. (2008), and
- **(11)** Integrated knowledge management model by Frost (2014).

The **(1)** knowledge categories and transformation model by Hedlund & Nonaka (1993) is illustrated in Figure 5.10 below and specifically categorises two types of knowledge and how they transfer in the transformation process from individuals to the entire organisation. The first distinction is the distinguishing between articulated and tacit knowledge. He defines articulated knowledge (AK) as either verbal, drawings, writings, computer programs, patents, etc. while tacit knowledge is as defined above, non-verbalised/verbalisable, intuitive, unarticulated knowledge type. The second distinction is the distinguishing between the four carriers of knowledge, namely, individual, small group, organisation, and inter-organisational (loyal/valuable customers, suppliers, competitors etc.).

This model allows for explicit differentiation between storage, transfer and transformation, and is described in three basic concepts as follows:

- ***Articulation and internalisation:*** The interaction between tacit and articulated knowledge is called reflection and articulation indicates the process whereby tacit becomes articulate while the internalisation is the vice versa process. The expansion is where articulation essentially facilitates the transfer and improvement of information.
- ***Extension and appropriation****:* The interaction between extension and appropriation is called dialogue, where extension is the transfer of knowledge (either tacit or articulate) between carrier levels from individual to inter-organisational domain while appropriation is the reversed process.
- ***Assimilation and dissemination:*** Refers to the importing of knowledge from and exporting to the environment.

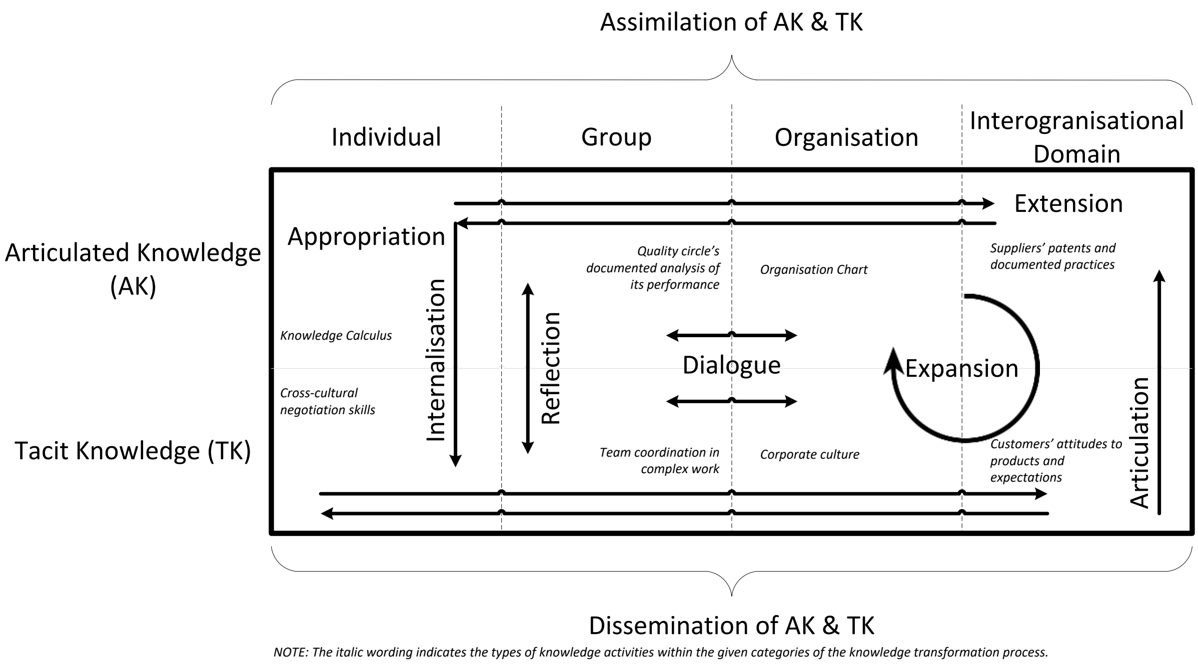


Figure 5.10: Knowledge Categories and Transformation Process Model by Hedlund & Nonaka (1993) adapted from Hedlund (1994, p. 75-77)

The **(2)** knowledge network spiral model by Nonaka & Takeuchi (1995) in Figure 5.11 below, illustrates the exchange process on how knowledge is newly created from individual through to the organisation. It is also divided into four modes, namely socialisation, externalisation, combination and internalisation which is discussed in more detail on the follow-up model by Nonaka *et al.* (2001).

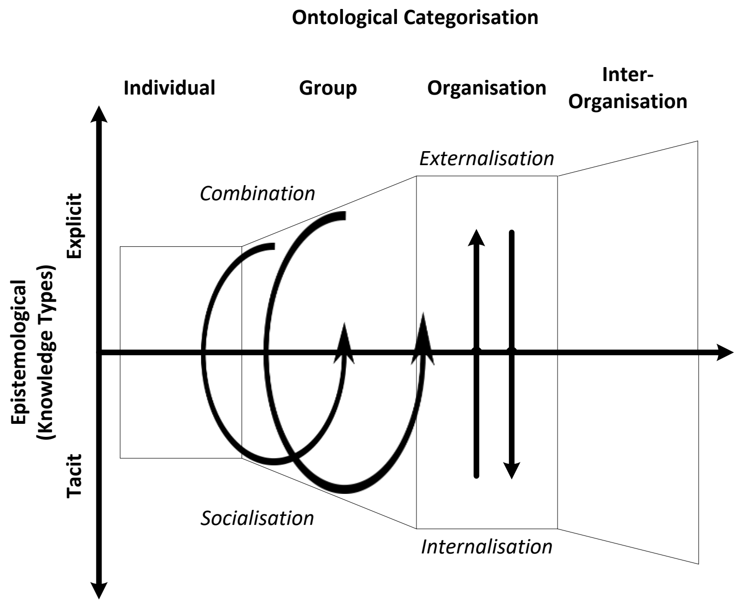


Figure 5.11: Knowledge Network Spiral by Nonaka & Takeuchi (1995) adapted from Schutte (2010)

The **(3)** knowledge management process framework by Bukowitz & Williams (1999) as illustrated in Figure 5.12 below, is divided into two main components affecting the framework, namely tactical and strategic. The tactical component revolves around the information gathering process whereby knowledge is used to create value; the organisation learns from the knowledge and ultimately contributes back into the system for collective learning in the organisation. The strategic component revolves around aligning the organisational goals with the organisational knowledge strategy through realising the value created in the tactical component process.

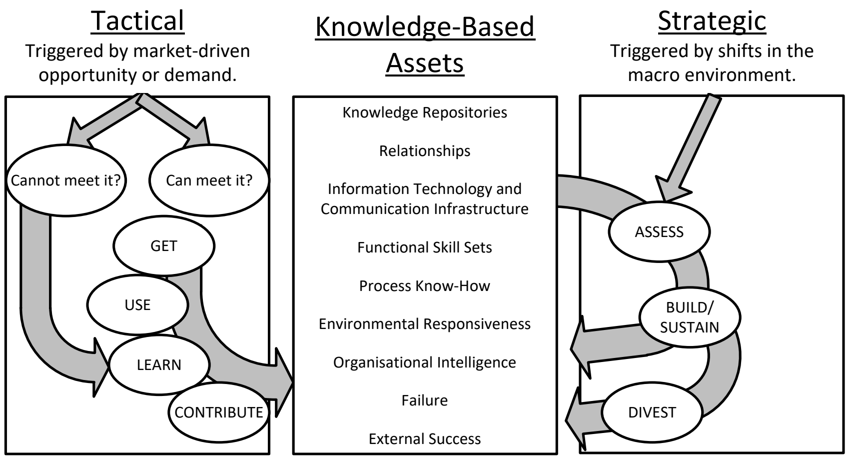


Figure 5.12: The Knowledge Management Process Framework adapted from Bukowitz & Williams (1999)

The **(4)** general knowledge model by Newman & Conrad (2000) is illustrated in Figure 5.13 below and categorises knowledge into four modes which are described below. Another similar knowledge work process model is by Back *et al.* (2005), but will not be discussed in detail in this research thesis due to its similarity.

- ***Knowledge creation*** is comprised of the process associated to developing, discovering and capturing of new knowledge into the system.

- ***Knowledge retention*** is the mechanism retaining and preserving the viability of the knowledge once it has entered the system.
- ***Knowledge transfer*** is the process whereby knowledge flows between individuals and includes communication, translation, conversion, filtering and rending (Schutte, 2010).
- ***Knowledge utilisation*** is where the knowledge is applied in the organisational processes.

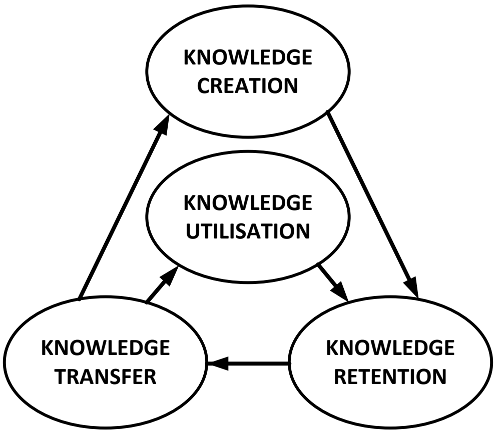


Figure 5.13: General Knowledge Model adapted from Newman & Conrad (2000)

The **(5)** organisational knowledge creation SECI model by Nonaka et al. (2001) in Figure 5.14 below builds on the knowledge network spiral by Nonaka & Takeuchi (1995) as it is divided into four modes of knowledge conversion. Their four modes are described as follows:

- ***Tacit to Tacit (Socialisation):*** This is the social interaction where tacit knowledge is shared, and tacit knowledge is created through direction experiences (e.g. traditional apprenticeships).
- ***Tacit to Explicit (Externalisation):*** This is the articulation of tacit knowledge through dialogue and reflections which enable communication causing crystallisation of knowledge into explicit knowledge. This allows the knowledge to be shared by others and forms the basis of new knowledge.
- ***Explicit to Explicit (Combination):*** This is the systemising and application of explicit knowledge and information collected internally and externally to the organisation and combined, edited and/or processed to create new knowledge (e.g. big data mining).
- ***Explicit to Tacit (Internalisation):*** This is the learning and acquiring of the new tacit knowledge created in practice whereby the explicit knowledge is internalised by the individual.

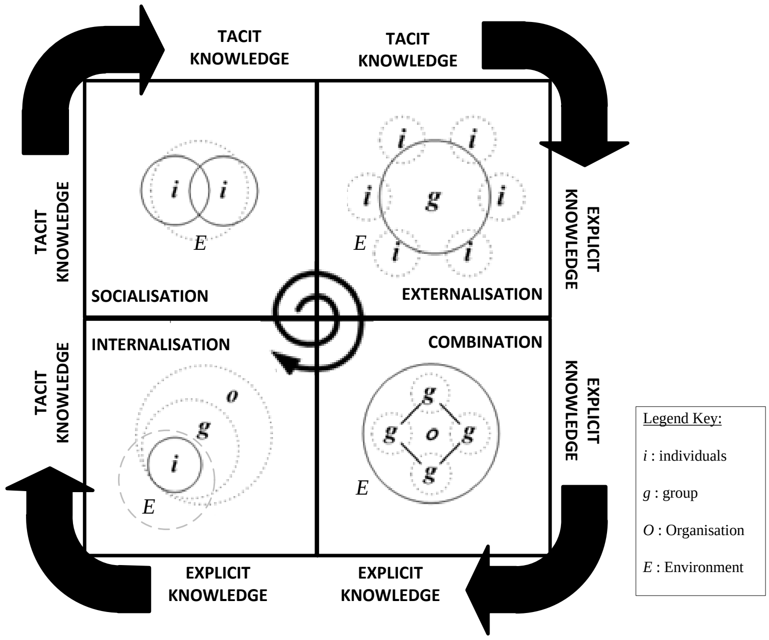


Figure 5.14: Organisational Knowledge Creation SECI Model adapted from Nonaka et al. (1995)

The **(6)** knowledge management matrix by Gamble & Blackwell (2001) is illustrated in Figure 5.15 below and is a useful overview model of knowledge management with specific guidelines for implementation. The implementation process is divided into four stages with the first stage requiring management to identify the knowledge source. The second stage involves using the knowledge source to assess the organisation's strengths and weaknesses, as well as to determine its reusability and application. The third stage is where the knowledge is socialised, whereby numerous techniques and tools can be used to share and disseminate the knowledge throughout the organisation. The final stage involves the internalisation of the knowledge through the application of the knowledge.

TYPE / APPROACH	EMBODDIED	REPRESENTED	EMBEDDED
SENSE	Observe	Gather	Hypothsize
ORGANISE	Contextualise	Categorise	Map
SOCIALISE	Share	Disseminate	Stimulate
INTERNALISE	**Apply, Decide, Act**		

Figure 5.15: Knowledge Management Matrix adapted from Gamble & Blackwell (2001)

This beneficial use of this model is that it provides a useful overview for sharing and retrieval of existing knowledge. The ultimate limitation of the model is that it is limited to knowledge being shared and omits the aspects of knowledge acquisition, creation and divestment (Frost, 2014).

The **(7)** knowledge-based network organisation model by Bornemann *et al.* (2003) is illustrated in Figure 5.16 below. This model is based on two perspectives, the topographic perspective and the knowledge perspective. Due to the intrinsic link between people and knowledge, the geographical location can play a vital role. From the topographic perspective, the organisation is structured as the accumulation of locations and departments, while the knowledge perspective is aimed at optimal acquisition and networking of knowledge through knowledge domains, which can also be virtual departments/domains.

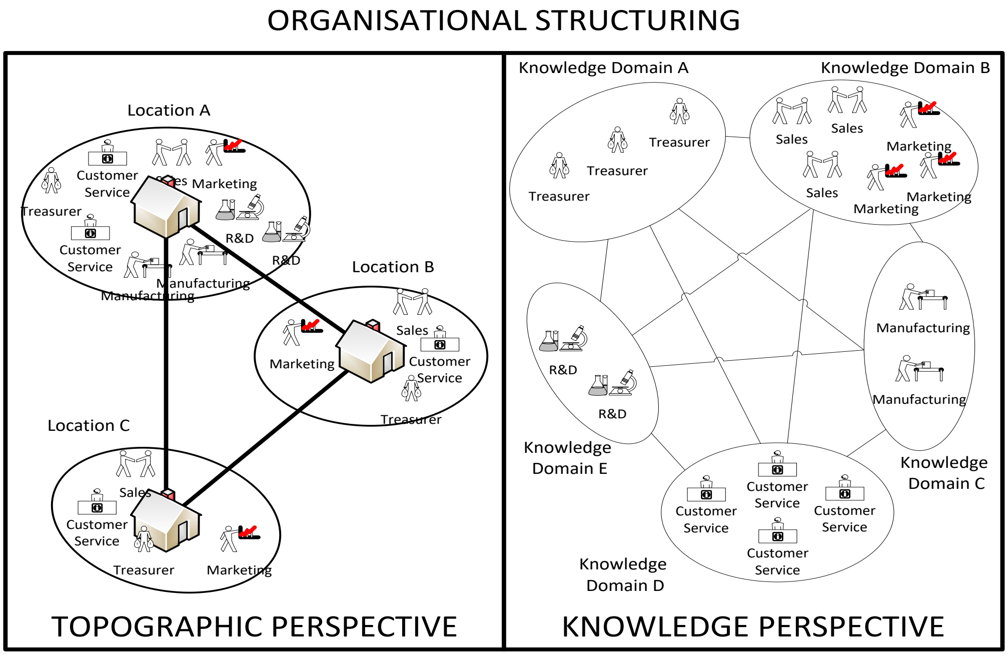


Figure 5.16: Knowledge-Based Network Organisation adapted from Bornemann *et al.* (2003) and Schutte (2010)

The **(8)** knowledge creation and application of projects framework by Bornemann *et al.* (2003), is illustrated in Figure 5.17 below. This simplified model explains how knowledge is created, applied and stored for a typical project. It is an important for evaluating whether an organisation's culture is inhibiting or stimulating innovation.

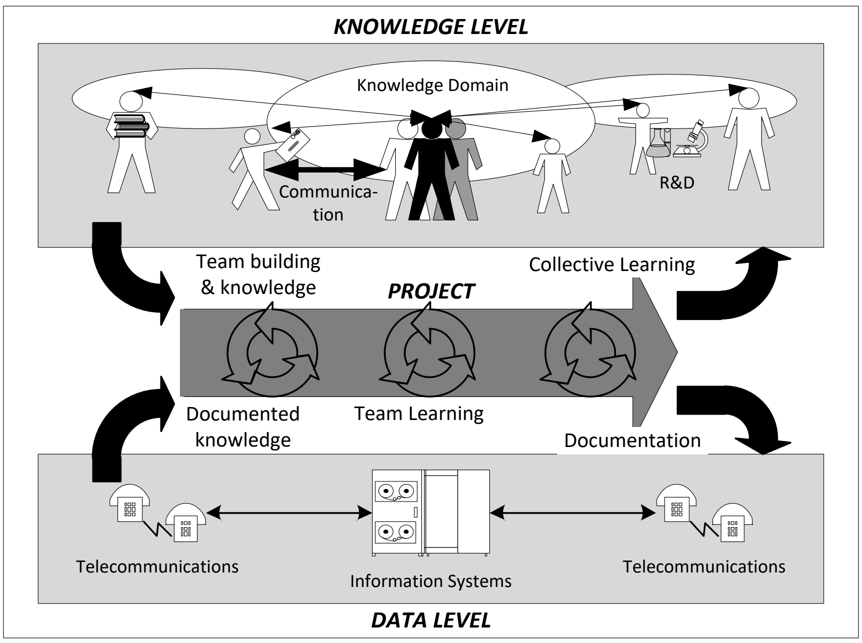


Figure 5.17: Knowledge Creation and Application of Projects Framework adapted from Bornemann *et al.* (2003)

The **(9)** centralised knowledge management system (KMS) by Maier (2004) is illustrated in Figure 5.18 below. It is one of two types of organisational knowledge and information architecture systems, the other being Peer-to-Peer KMS. The drawback of these architecture systems is that they are overly rooted in information sciences and lack the ability to support all aspects of knowledge management.

Of the two systems, the centralised KMS is more preferred as the Peer-to-Peer KMS has high costs associated with it and lacks proper management of access. However, the Peer-to-Peer KMS reduces and/or addresses numerous problems found with the centralised KMS. The main problem with these KMSs is that they are primarily information systems and structured for sharing knowledge, but lack the process of creating new knowledge.

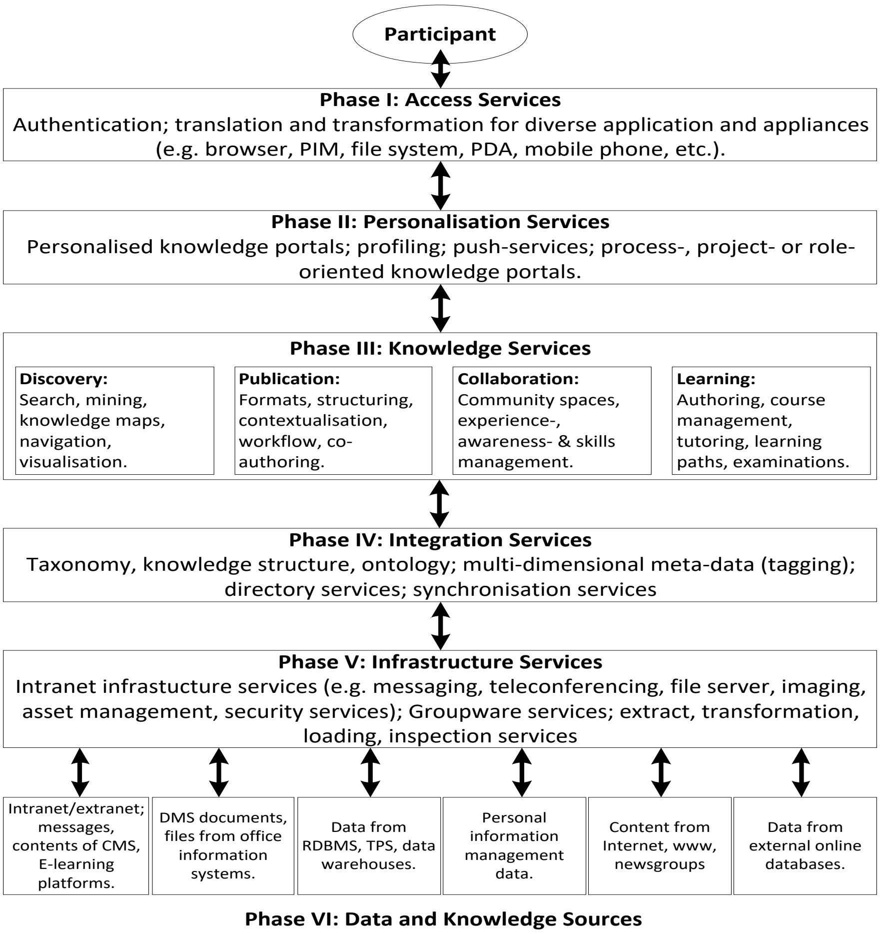


Figure 5.18: Centralised Knowledge Management System adapted from Maier (2004)

The **(10)** knowledge management process model by Botha *et al*. (2008) is illustrated in Figure 5.19 below and the purpose of this model is to put people and information in context, to improve the business performance through new innovative processes, and to change the organisations behaviour to become more of a learning organisation. This is achieved in the model by the following key activities:

- ***Create and Sense:*** The result of these activities is that new and/or assemblies of existing knowledge are created.

- ***Capture:*** Here all activities are recorded, and tacit knowledge is converted into explicit knowledge as the knowledge is also disseminated from the individual through to the rest of the team, community and/or organisation.
- ***Organise:*** This is the navigation, storing and recovery activities whereby knowledge is classified, mapped, indexed and categorised.
- ***Personalise:*** This is where knowledge is internalised and made specific to the individual, community or organisation.
- ***Share and collaborate:*** These are two activities where the knowledge is applied to the organisation's processes as decisions and/or opportunities. The 'collaborate' activity is a recursive activity whereby continuous feedback is generated and integrated into the organisation's processes.
- ***Access:*** These are the activities revolving around disseminating knowledge to the organisation's users as either displaying knowledge (translate, format and publish) or accessing knowledge (browse, search and examine).

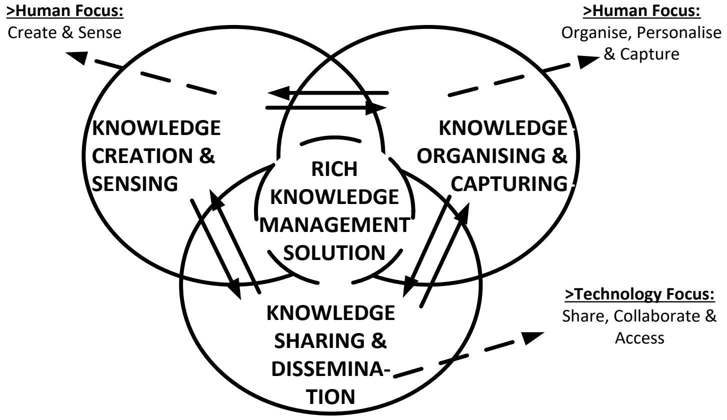


Figure 5.19: Knowledge Management Process Model adapted from Botha *et al.* (2008)

The **(11)** integrated knowledge management model[90] by Frost (2014), is illustrated in Figure 5.20 below and is aimed at linking the organisation's process and strategy while contributing at different stages to specific initiatives. The model also provides the relationship between information and knowledge management systems to the organisation's processes and strategy. Nonaka & Takeuchi (1995), Bukowitz & Williams (1999), Gamble & Blackwell (2001) and Botha et al. (2008) developed this model based on the earlier work. It has four major aspects to it, namely, the organisational memory[91] that is based on the work done by Walsh & Ungson (1991) and Ramage & Reif (1996), the information systems and data repositories, the organisation's strategies and tactics, and lastly the sequential knowledge management process.

[90] Frost, A., 2014. *An Integrated Knowledge Management Model*. [Online] Available at http://www.knowledge-management-tools.net/knowledge-management-model.html [Accessed on 13 August 2014].
[91] Frost, A., 2014. *Organizational Memory and Knowledge Repositories*. [Online] Available at http://www.knowledge-management-tools.net/organizational-memory-and-knowledge.html [Accessed on 13 August 2014].

In order to provide an overview of the knowledge management process, a sequential and simplified stepwise process will be discussed and includes the following steps:

- ***Detect & Discover:*** Is where existing and hidden knowledge within information and data is searched for and discovered.
- ***Organise & Access:*** Is where the knowledge assets are assessed and organised whereby knowledge is categorised, evaluated and mapped.
- Tactical Initiatives of Knowledge Management Processes:
    - ***Act – Reuse:*** Is where an organisation meets tactical opportunities or threats through using existing knowledge. The key role of knowledge management here is for the person/group/community to detect the knowledge, organise it and to share it.
    - ***Act – Create/Acquire:*** Is where new knowledge needs to be created or acquired to meet the tactical opportunity or threat. The key requirement of knowledge management is to have the adequate supporting processes and systems to enable knowledge creation through combining and converting knowledge assets.
    - ***Failure to Act:*** Is where the organisation does not have sufficient knowledge management processes or systems to act on the tactical opportunity or threat. The lesson to be learnt from this is that the lack of knowledge management can play a vital role in future strategic decisions.
- Strategic Initiatives of Knowledge Management Processes:
    - ***Invest – Support or Implement:*** Is where the knowledge management initiatives discussed above are considered as part of a long-term strategic initiative. This includes creating the right environment through redirecting the organisation's competencies, culture, external networks, knowledge retention, structures and systems to enable the mentioned tactical initiatives to the competitive advantage of the organisation.
    - ***Divest:*** Is where the role of knowledge management is to maintain the relevant knowledge assets as they can become obsolete over time, being required to be removed.

Other important aspects to note about this model is that the model itself is continuously looping as new knowledge is created, existing knowledge is modified and obsolete knowledge is removed, whereby this information is fed straight into the information systems and repositories which ultimately become the organisational memory.

This model, therefore, allows the organisation to combine information, strategy and the organisation's memory to become a learning and innovative organisation that can sustain its competitive advantage. This integrated knowledge management model cannot be regarded as all-inclusive, but provides a good overview of the important aspects required in knowledge management models.

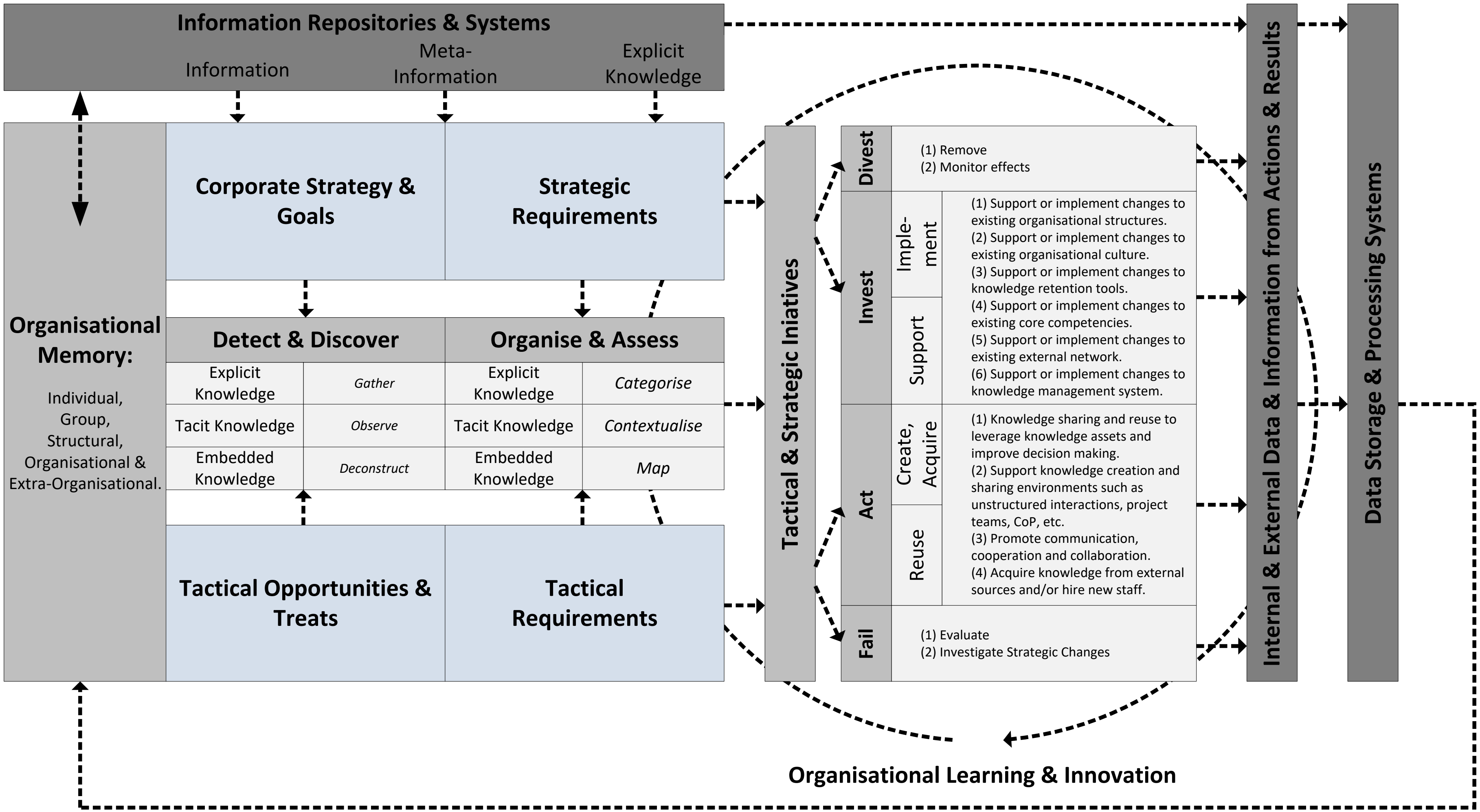


Figure 5.20: Integrated Knowledge Management Model adapted from Frost (2014)

5.3. INNOVATION AND INTEGRATED KNOWLEDGE NETWORKS

In this section, the core focus is the relation between innovation and knowledge. An argument for this relationship will be made while the relationship between knowledge networks and innovation will specifically be discussed in more detail. The purpose of knowledge networks, as well as an integrated knowledge network framework, will be explained in more detail.

5.3.1. KNOWLEDGE AND INNOVATION MANAGEMENT

When describing both knowledge and innovation (refer to Chapter 3), there are numerous definitions, classifications and different criteria for both in literature. The same goes for the fields of both knowledge and innovation management. Nonetheless, there are distinguishing similarities, relations and differences.

In distinguishing some similarities and differences, it is first important to also recall the differences between innovation and invention, which is that inventions are ideas manifested into product/system/services, while innovation is the successful application thereof in practice. Knowledge, on the other hand, is similar in some cases to the concept of the invention but not necessarily to the commercial use. However, market competition causes knowledge creation and dissemination to become vital to the organisation's performance and competitive advantages. This is because experience transforms knowledge into commercial results. In these two examples, it is clear that many aspects between the process of innovation and the process of knowledge creation and/or transformation are both similar and different. This is especially true when considering the typology of innovation and the combination of different knowledge types to form different combinations of innovation types.

The key relations between knowledge and innovation management as highlighted by researchers is that knowledge management supports the efficiency of innovation management (Johannessen, *et al*., 1999; Pérez-Bustamante, 1999; Carneiro, 2000; Burgelman, *et al*., 2008). This is because, for numerous aspects, innovation is dependent on the creation of knowledge. For the purpose of this research study, the relation between knowledge and innovation management will be regarded as important for the development of the conceptual Framework.

5.3.2. KNOWLEDGE NETWORKS AND INNOVATION

While the innovation landscape has evolved drastically over the past few decades (as illustrated in Chapter 3), it is evident that simple linear models have been replaced by more complex network, collaboration and integrated models (Schutte, 2010). The role of open innovation and extended innovation models requires a paradigm shift in implementation and integration of knowledge, systems and structures. In this paradigm shift, the role of integrated knowledge networks and its effect on this change will be discussed in more detail in this section.

According to Du Preez *et al.* (2008), integrated knowledge networks are defined as the number and relationship between people and resources that are "*able to capture, transfer and create knowledge for the purpose of creating value*". They went on to state that sustainable innovation is fostered through the relationships between all domains, communities and trust relationships, and will promote competitiveness for its users.

In order to further understand the purpose of knowledge networks, one must understand the role of knowledge networks in knowledge management. According to Schutte (2010), knowledge networks form part of the third generation of knowledge management initiatives as defined by Walsham (2001). Seufert *et al*. (1999) and Schutte (2010) defined knowledge networks as follows: "*A number of people, resources and relationships among them, who are assembled in order to accumulate and use knowledge primarily by means of knowledge creation and transfer processes, for the purpose of creating value".*

It also is important to note that knowledge and innovation are always connected to people, individuals and/or groups, and organisations. This supports the role of both knowledge and human capital in the development of innovation. The key relationship between integrated knowledge networks and innovation is that integrated knowledge networks "*enable inter- and intra-(organisations) teams to innovate using their collective experience, and expanding their knowledge*" (Schutte & Du Preez, 2008).

The main conceptual components of integrated knowledge networks are illustrated in Figure 5.21 below. This includes joint research interest, inter-organisational collaboration, formal alignment of systems and processes, and knowledge networking. While there are numerous unique challenges that impede the implementation of integrated knowledge networks, each of these components is key to the implementation of integrated knowledge networks.

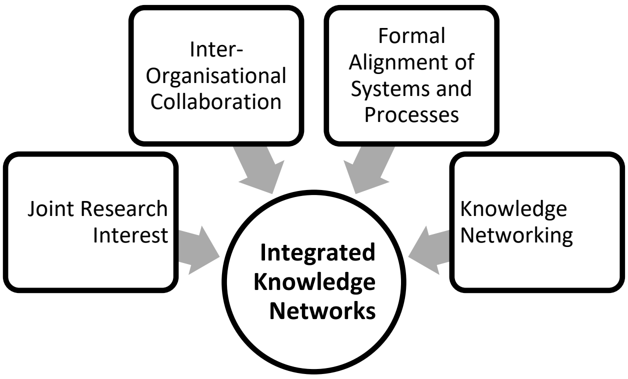


Figure 5.21: Integrated Knowledge Networks' Conceptual Components adopted from Schutte (2010, p. 45)

5.3.3. KNOWLEDGE NETWORKS PURPOSE AND LANDSCAPE

In the research by Anklam (2007) and Von Krogh *et al.* (2001), the purpose of knowledge networks is defined, as well as Anklam's purpose subsuming the purpose of Von Krogh *et al.* (2001). Nonetheless, the research of Von Krogh *et al.* (2001) indicates three key business objectives for knowledge networks that include:

- **Efficiency improvement:** The efficiency improvement relates mainly to the ease of accessibility and creating new applications for knowledge. The creation of new knowledge must also be aligned with the innovation goals. Examples of such aspects/situations include government policy decision-making and reaction strategies, reaction to and from competitors' strategies, resource overtaxing, to name a few.
- **Innovation increase:** The creation and application of new knowledge for businesses is not sufficient, as it needs to not only be a technology push, aligned with market pull factors. It requires the innovation goals to be aligned with the needs of customers and building loyal customer relations.
- **Risk optimisation:** This implies the reduction of the knowledge supply chain in terms of costs and time, it also includes best marketing and human resource practices sharing, as well as leveraging of existing and new product development costs across departments, to name a few.

Anklam (2007) defines knowledge network purposes as characterised in a taxonomy, which is listed below in Table 5.7. This taxonomy is categorised into five types of knowledge network purposes, namely, mission network, business network, idea network, learning network, and personal growth and support network. Their respective design motivations and network dimensions are also described in Table 5.7.

Table 5.7: Taxonomy of Knowledge Network Purposes by Anklam (2007) adapted from Schutte (2010)

Type of Purpose	Design Motivation	Network Dimensions
Business	Creating tangible value through business development, financial wealth, production of goods and services, or any project or operational output-focused endeavour.	• For-profit organisations' main dimensions are production and growth through revenue, profits, return on investments, market share, product breadth, expertise and knowledge. • Non-profit organisations' main dimensions are growth through partners acquired; alliances formed and maintained, customer focus and development, and leveraging of network for strategic change.
Idea	Create an exchange environment for generating new thinking on problem solving, inventions, advocacy and/or innovations.	Platform (virtual or physical) enabling creative idea exchange between members (semi-formal interested parties).
Learning	Continuous improvement and enhancement of personal or collective knowledge.	Multiple dimensions of individual and/or group capacity growth in avocation, expertise, knowledge, skills, or vocation.
Mission	Social or environmental development at local, national, regional or global level.	Strategic dualistic dimension of creating an organisation's network to develop and maintain programmes and a network within the targeted population.
Personal Growth & Support	Organic and random growth of personal network, which is leveraged for individual support, knowledge, and growth.	Multiple informal dimensions such as families, friends from school, colleagues, neighbours, and people we know through civic, religious or wellness activities.

It is evident that knowledge networks have numerous purposes and dimensions depending on the type of knowledge network planned to be implemented and the landscape within which it must be implemented. It can further be differentiated into different knowledge network variants which are derived from the knowledge network purposes and is illustrated in Figure 5.22 below. In this hierarchy of knowledge network variants, only a few general sub-networks were mentioned for conceptual purposes as numerous more knowledge networks exist.

In Table 5.8 below, a selected group of different knowledge network variants is selected for their association and general use in the innovation landscape of knowledge networks. These selected knowledge network variants are processes whereby knowledge is created within a specific network to foster innovation, while different labelling is used for the different terminology. The common characteristics of the different knowledge network variants described in Table 5.8, are defined as follows:

- **Purpose:** Summary of the purpose for the knowledge network variant.
- **Purpose Category:** Categorised according to Anklam (2007) knowledge network purpose taxonomy.
- **Individual Participant's Commercial Focus:** Defined as the individuals that participate in either an individual or an organisational capacity that are executing the network activities with a commercial focus.
- **Openness of Association:** Accessibility and openness of new members joining and participating.
- **Member Synergy:** The foremost motive for participation and synergy within the knowledge network.
- **Organisational Participation:** The level of organisation participation within the knowledge network.
- **Formalisation:** The network's degree of formality (informal/semi-formal/mostly formal/formal).

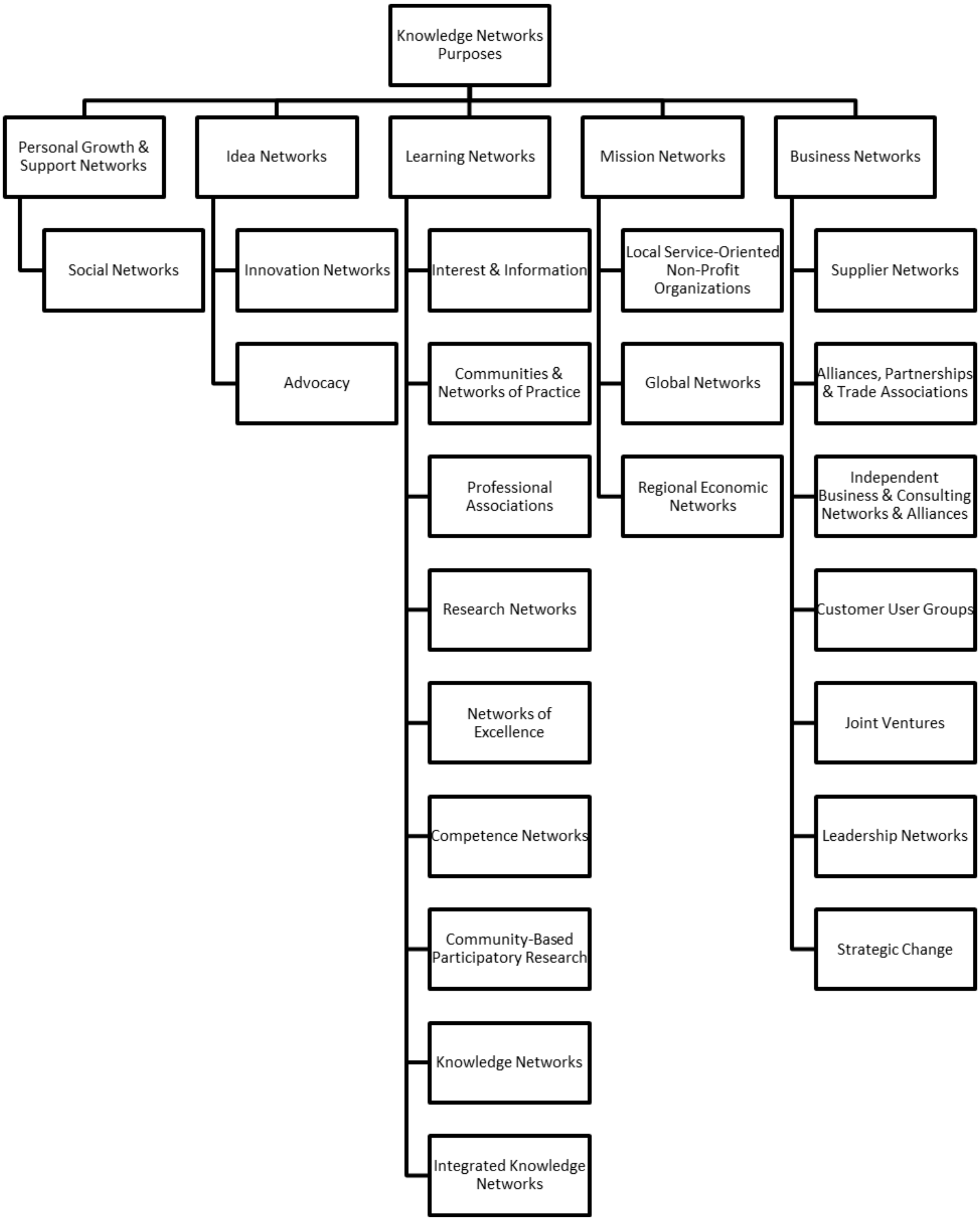


Figure 5.22: Knowledge Network Variants derived from Knowledge Networks Purposes adapted from Schutte (2010, p. 69)

Table 5.8: Summary of Knowledge Network Variations' Characteristics adapted from Schutte (2010, p. 76–77)

Network Variants	Purpose	Purpose Category	Individual Participant's Commercial Focus	Openness of Association	Member Synergy	Organisational Participation	Formalisation
Social Networks	Social interaction with other members sharing similar interests	Personal	No	Open – interested members join group.	Group Identification	Private Individuals	Informal
Communities & Networks of Practice	Build member capabilities within a specific domain	Learning	Indirectly yes – individuals' personal knowledge improvement attempts are indirectly an organisational advantage.	Open – members generally select themselves within a single organisation.	Commitment, passion & group identification.	Generally individuals within a single organisation.	Informal
Knowledge Networks	Collect & distribution of knowledge	Learning	Yes	Generally by invitation	Mutual needs, job requirements, common goals.	Generally individuals within a single organisation.	Formal
Networks of Excellence	A common research goal & project	Learning	Yes – research focus	By invitation	Common research goal on the organisational level	Transnational organisation	Formal
Community-Based Participatory Research	A research partnership between domain experts & members of the research subject group	Learning	Yes, from the participating organisation's perspective, and no from the member community perspective.	Generally closed. Domain experts are members of a parent organisation. Community members are invited to participate because they are firstly a member of an existing community with certain characteristics.	Domain experts: Common research goal. Community members: Common characteristics	Researchers from one or more organisations and members from the research subject community.	Mostly formal, but members from the participating subject community have a more informal participation.

Table 5.8 Continued: Summary of Knowledge Network Variations' Characteristics adapted from Schutte (2010)

Network Variants	Purpose	Purpose Category	Individual Participant's Commercial Focus	Openness of Association	Member Synergy	Organisational Participation	Formalisation
Joint Ventures	A risk & cost sharing of a commercial purpose between organisations.	Business	Yes	Commercial negotiation.	Common commercial goal	Multiple organisations	Formal
Innovation Networks	Ensuring the successful commercialisation of new inventions.	Idea & Business	Yes	Commercial negotiation.	Commercialisation of an innovative idea.	Multiple organisations	Formal
Competence Networks	Networks created to bring individuals & organisations together to share knowledge within a certain competence area.	Learning Mission	Yes	Open – often determined by region.	Mutually need to share the knowledge associated with a certain skill or competence, to advance a specific region.	Normally on the organisational level.	Formal
Integrated Knowledge Networks	Collect & share common research knowledge in a specific domain between members of the same & different organisations.	Learning, Idea & Business	Yes	Normally by invitation & commercial negotiation.	Mutual needs & goals on the organisational level.	Individuals in multiple organisations (even trans-national).	Formal

These knowledge network variants form part of the innovation landscape as illustrated in Figure 5.23 below. According to Du Preez & Louw (2008), for businesses to exploit open innovation concepts, they should develop integrated knowledge networks that will support the innovation knowledge value chain. The main role players identified in the innovation knowledge value chain can be integrated to create a knowledge network. Therefore, integrated knowledge networks can then be defined as "*an inter-organisational version of the knowledge network*" (Schutte & Du Preez, 2008). This means that integrated knowledge networks constitute numerous knowledge networks throughout the innovation knowledge value chain.

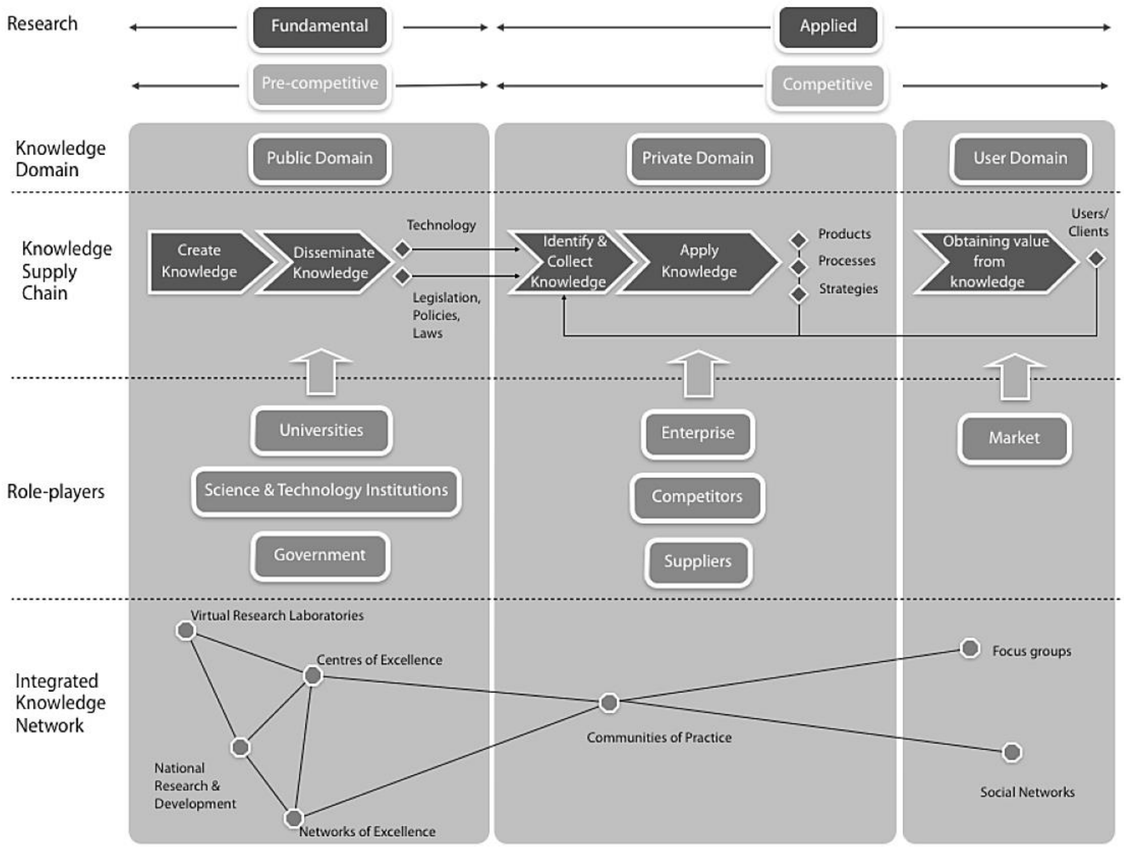


Figure 5.23: The Innovation Landscape with Integrated Knowledge Network Components Supporting the Innovation Knowledge Value Chain adapted from Du Preez & Louw (2008) and Du Preez *et al.* (2013)

For the purpose of this research study, different knowledge networks that are relevant to enhancing the process of information and knowledge flow/transfer and the innovation process will be integrated and combined. This is specifically for the relevance of developing a complex system and conceptual framework, as the different stages within the commercialisation process will constitute different stages in the innovation knowledge supply chain.

5.3.4. KNOWLEDGE NETWORK LIFE CYCLES

In discussing the innovation knowledge supply chain, it is evident that there is an important relationship between the knowledge and innovation life cycles. This important relationship between knowledge and innovation management focuses on how knowledge networks can improve the innovation process. In this comparison, the FUGLE innovation life cycle (refer to Chapter 3) was used to illustrate the innovation process and to establish a benchmark. This comparison is illustrated in Figure 5.24 below, while the selected knowledge network variants rationale are defined as follows (Schutte, 2010):

- **Social Networks:** Social interaction whereby ideas are exchanged in an informal manner and can be related to a possible domain area because of personal interests, thus supporting the stage of Idea Generation, and partly the stage of Conceptual Defining.
- **Communities of Practice:** Experts of a specific domain exchange knowledge in an informal manner for learning that focuses more on the invention phase of the innovation process.
- **Competence Networks:** Similar to Communities of Practice, but more focused on the exchange of information in a formal manner, within a specific region and competence level.
- **Community-Based Participatory Research (CBPR):** The members are domain experts with a common goal whereby the inventor will have a personal stake in the process from research to some of the commercialisation stages.
- **Networks of Excellence:** Similar to CBPR with members having a common research goal and project, but from an organisational level there is more purpose for the development stage. Motivational incentives from the organisation to its members become crucial for success.
- **Innovation Networks:** Often established after inventions are created for support in commercialising the inventions and can involve multiple organisations in a formal manner.
- **Joint Ventures:** Usually use a risk and cost sharing mechanism to mitigate the risk burden of commercialising alone. This network variant has a formal common commercial between multiple organisations and involves taking inventions through the commercialisation phase.
- **Knowledge Networks and Integrated Knowledge Networks:** Schutte (2010) defined integrated knowledge networks specifically for the supporting role of knowledge networks throughout the full innovation life cycle. This is done through leveraging mutual needs and goals on the organisational level with learning, ideas and commercial purposes.

This conceptual illustration of the relationship between different knowledge network variants and innovation processes clearly indicates the important role and relationship between knowledge and innovation management. It also clearly illustrates the role of integrated knowledge networks in combining numerous knowledge networks to support the knowledge transfer and learning process throughout the innovation process. This contributes to another reason for choosing integrated knowledge networks as best practice in knowledge management and for the supporting role in developing a conceptual framework.

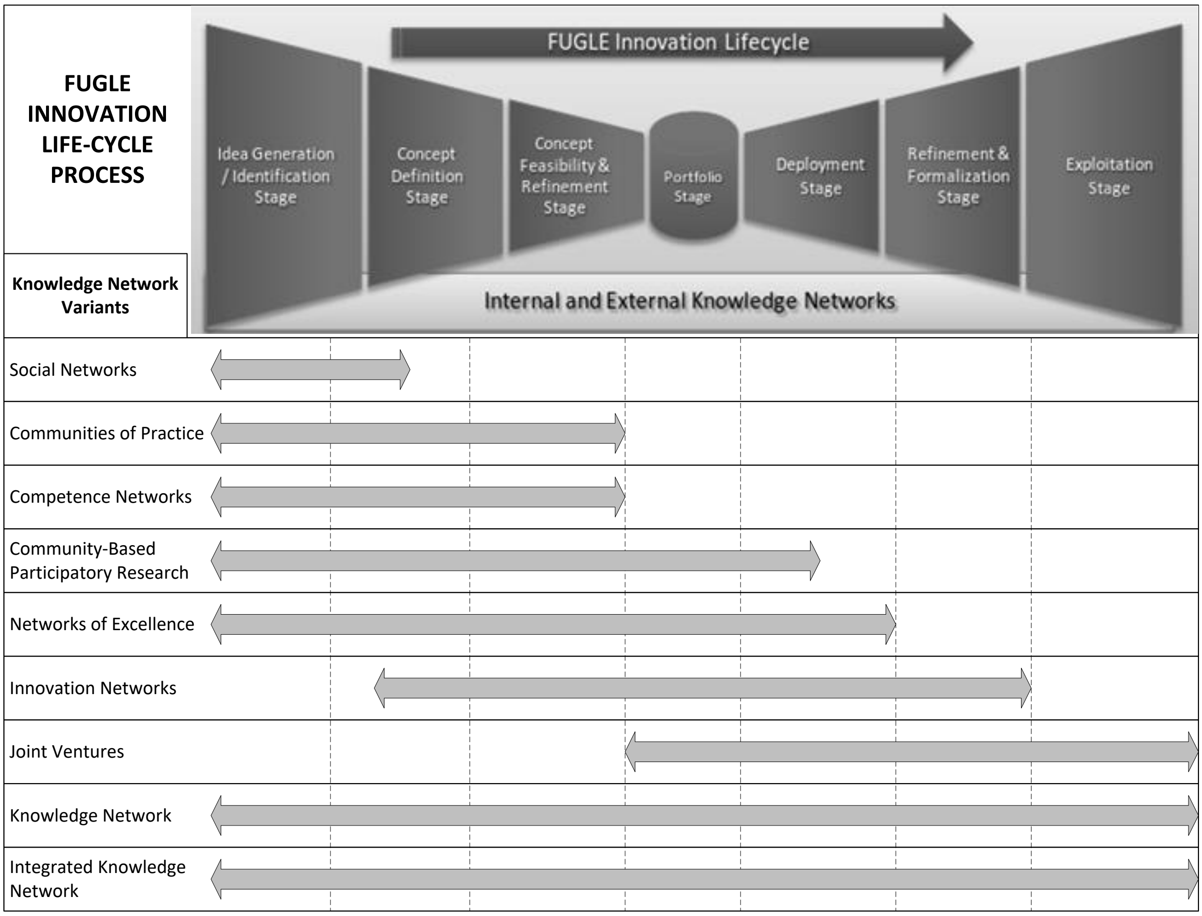


Figure 5.24: Knowledge Networks' Suitability for Supporting the Innovation Life Cycle adapted from Schutte (2010, p. 78)

5.3.5. INTEGRATED KNOWLEDGE NETWORK FRAMEWORK

With very limited research available on integrated knowledge network systems, models and frameworks, the integrated knowledge network framework by Schutte (2010) was specifically chosen as the best practice. This framework specifically looks at implementation of knowledge networks instead of the usual knowledge management system. Schutte defined his framework based on a three-dimensional requirements analysis which is illustrated in Figure 5.25 below and the dimensions are summarised as follows:

- **Knowledge Network Purpose:** Why does the knowledge network exist? What are its purpose and objectives? This is illustrated and discussed in Figure 5.22 and Table 5.8 above as documented in the research by Anklam (2007).
- **Knowledge Network Functional Requirements:** What are the functions required to fulfil the purpose of the knowledge network? This is divided into two requirements being:
    - Create and share knowledge;
    - Connect individual people and organisations.

- **Knowledge Network Methodology Requirements:** What is the expected methodology to design, create, implement, refine and phase-out a knowledge network? This is divided into four requirements, being:
    - Define Control Targets and Measurements;
    - Establish Knowledge Network Architecture;
    - Establish Knowledge Network Processes;
    - Encourage Facilitating Conditions.

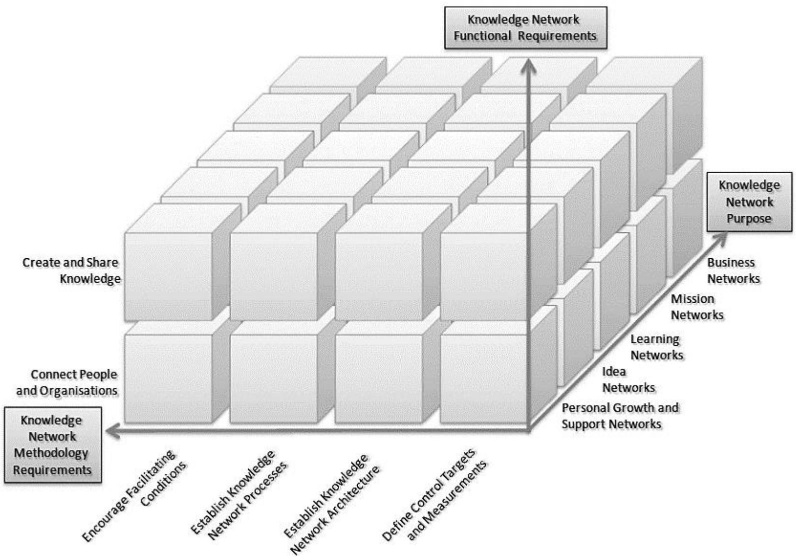


Figure 5.25: The Integrated Knowledge Network Framework Requirements adapted from Schutte (2010, p. 86).

After completion of the framework requirements analysis, the generic knowledge network framework can be applied for a given organisation or environment. The specific requirements and its relation to the framework, as well as the dimensions and requirements of the framework, are extensively described in the research by Schutte (2010) and will not be discussed in depth in this research study. The generic knowledge network framework is in a two-dimensional matrix, which is described as follows:

- **Matrix Horizontal Axis:** This axis uses the knowledge network life cycle which consists of the following phases:
    - **Designing:** Involves the proper planning and designing of a knowledge network to enable stakeholders to benefit effectively from the network. This phase is subdivided into three subphases, namely:
        - Determining the vision, strategic initiative, knowledge network domain and stakeholders of the knowledge network.
        - Apply the Requirements Analysis to establish the framework requirements.
        - Develop a detailed design and planning of the framework and respective knowledge network.

   - **Implementation:** Follows the detailed design process and considers the planning, preparation and eventual implementation of the knowledge network design. This phase has two subphases, namely:
     - Planning and preparation for the implementation process.
     - Rollout of the implementation plan and implement the process.
   - **Operations and Refinement:** After implementation, the operations of the knowledge network is managed. Performance analysis and evaluation of the operations must be continuously performed and managed whereby improvements are done through the refined design and redeployment of the operations.
   - **Phase-Out:** Networks that have decreased levels of activity and poor performance evaluation because of achieving its objectives, failing or the refinement process failing to restore/improve performance can be considered to be phased-out. This process involves the both the planning and the execution of the phase-out.
- **Matrix Vertical Axis:** Employs a basic system engineering approach, which is divided into the input, knowledge network process (framework) and the output.
   - **Inputs:** In order for the knowledge network function to achieve its objective output, numerous inputs are required. These inputs are subdivided into the following four requirements:
     - **Vision and Strategy:** The knowledge network develops its direction through the vision, strategy and purpose that is used for the initial design stages.
     - **Requirements:** Derived from the vision and strategy whereby the network's requirements analysis is completed. The requirements analysis will primarily be done during the design phase and be continuously redefined in the knowledge network life cycle.
     - **Investment and Commitment:** Throughout the life cycle, activities will require resources, funding and time, which need to be evaluated with the objectives and benefits, expected and achieved for considering investment and commitment.
     - **Source Knowledge Domains:** Sourcing of knowledge from other domains to create knowledge whereby the IPR Strategy defines the boundaries and accessibility of the Source Knowledge Domains.
   - **Knowledge Network Process (Framework):** The knowledge framework incorporates the work by Back *et al.* (2005), which consists of the following:
     - **Facilitating Conditions:** These conditions are embodied and enabled by the key success factors and barriers mitigation as described by Forfás (2004). Both the success factors and barriers play a role throughout the knowledge network life cycle.
     - **Knowledge Work Processes:** This refers to the work processes and types of network references that are based on the work of Back et al. (2005) and are discussed at length by Schutte (2010, p. C-6).

- **Knowledge Network Architecture:** This consists of the Information Communication Technology (ICT) and organisational tools that are required to enable the knowledge network operations. All phases in the network life cycle will use specific tools.

- **Outputs:** This involves the execution of the developed knowledge network methodology and will consist of three main outputs:
    - **A Knowledge Network Design:** This is a network design output from the design phase and consists of the detailed design and planning in the knowledge network methodology.
    - **Created Knowledge:** The knowledge network is successful as new knowledge is created, captured and protected in the knowledge work process as well as measuring and evaluating the network's performance.
    - **Benefits:** Stakeholders will participate only if there is clear beneficial value proposition offered by the network. This benefit needs to be initially planned for, monitored during operations and analysed once the network is in phase-out.

The generic knowledge network framework is summarised with all the above-mentioned requirements and the components of the matrix are conceptually illustrated in Figure 5.26 below.

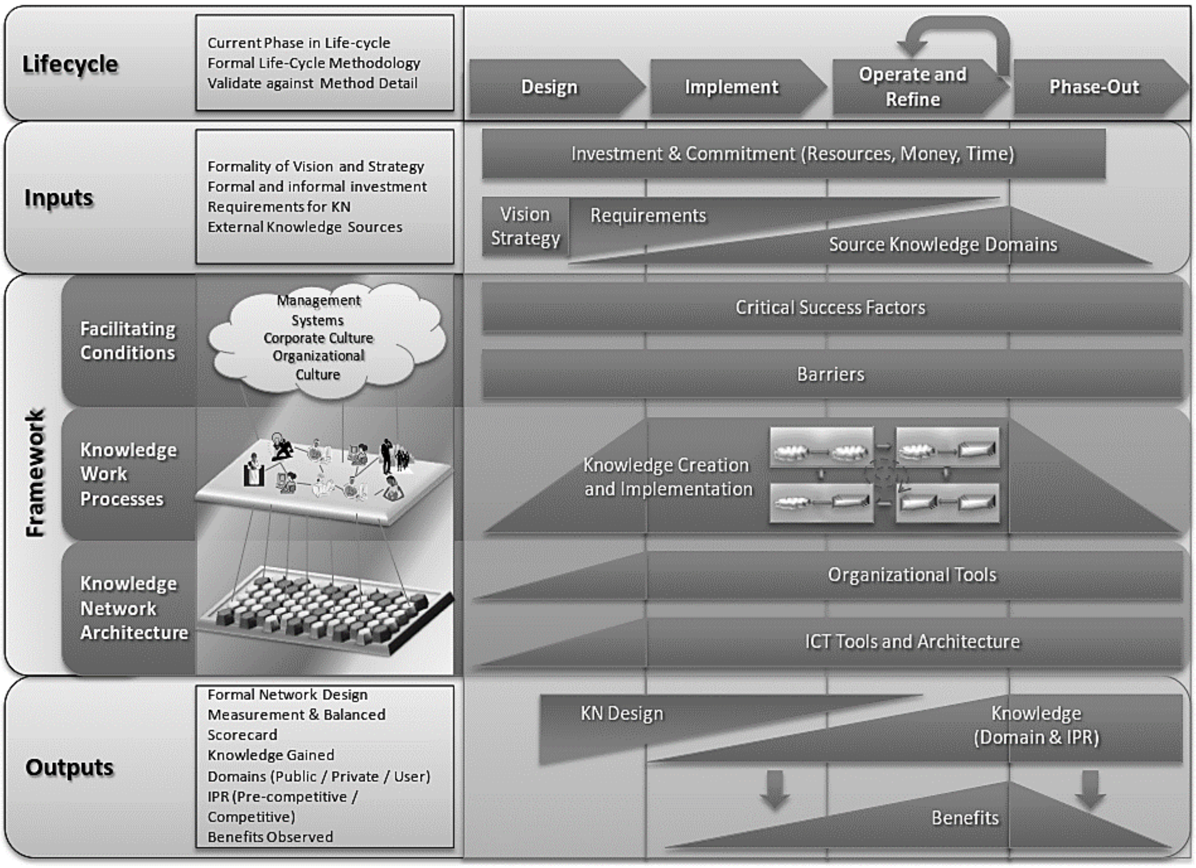


Figure 5.26: Generic Knowledge Network Framework adapted from Schutte (2010)

5.4. COOPERATIVES FOR ENTREPRENEURS, INNOVATION AND BUSINESS DEVELOPMENT

In this section, a literature review regarding cooperatives will be done, specifically focusing on cooperatives relating to entrepreneurship, innovation management and business development. The dynamics regarding cooperatives will be defined and discussed in detail, as well as the dynamics of cooperatives in the context of South Africa.

5.4.1. COOPERATIVES AS A BUSINESS ENTITY

5.4.1.1. A COOPERATIVES IDENTITY, VALUE & PRINCIPLES

In a literature review on cooperatives[92], it was found to have an accepted definition with the various sources all defining key similarities. The most widely accepted definition of a cooperative[93], is that of the International Cooperative Alliance[94] (ICA, 2012), who defined it as ***"an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically controlled enterprise and operated on cooperative principles"*** (Philip, 2003; Ortmann & King, 2007).

The history of the cooperative movement dates back to 1761, where cooperatives started out as small grassroots societies across Western Europe, North America and Japan. In 1844, Rochdale Pioneers revolutionised cooperates by starting a modern cooperative society, which in 1862 was converted into the first credit union by F.W. Raiffeisen (ICA, 2012). This inspired the growth around the world of the modern financial cooperative that today is estimated as a US$2 trillion sector with over 1 billion members and accounting for 100 million jobs (ICA, 2013).

With the cooperative's rich history, it can further be defined based on principles, key- and ethical values which were revised and updated, but essentially still based on its roots in 1844 (ICA, 2012). The six key values are democracy, equality, equity, self-help, self-responsibility and solidarity, while the ethical values aspire member to believe in *caring for others, honesty, openness* and *social responsibility*.

[92] *In the early seventeenth century, the Late Latin word cooperativus was formed from the Latin word cooperat- which means 'worked together' too eventually from the verb cooperari which means cooperate in English.*
[93] *Notably, this definition is also accepted in South Africa under the Co-operative Act 14 of 2005.*
[94] *The 'Cooperative Identity' was adopted by the International Co-operative Alliance at the Congress and General Assembly held in Manchester in 1995.*

As guidelines, cooperatives implement the above-mentioned values into practice through applying seven principles and objectives of the cooperative (ICA, 2012) which are:

(1) ***Voluntary and Open Membership:*** Cooperatives provide services that are open to all persons, without prejudice or discrimination, that is willing to accept membership responsibilities and that the organisation is voluntary.

(2) ***Democratic Member Control:*** Cooperatives are democratically controlled organisations providing equal voting rights (i.e. one member, one vote) for all primary cooperative levels while other levels are organised in a similar manner. Elected representatives accountable for the membership actively participate in making management decisions and in setting the respective policies.

(3) ***Member Economic Participation:*** Cooperative members democratically control and contribute equitable capital to the organisation as profit sharing. The reasoning behind the profit sharing can be for any of the following purposes: cooperative development, reserves, member benefits, other activities support, etc.

(4) ***Autonomy and Independence:*** Cooperative members control the autonomous and independent ('self-help') organisation through maintaining democratic control even in agreements with other organisations such as governments, or external sources for capital raising as an example. This is all outlined in the policies set by the cooperative.

(5) ***Education, Training and Information:*** Cooperatives effectively promote their benefits to the general public to strength the cooperative member base and contribute to the development of the cooperative by providing education and training to employees, managers, representatives and/or members.

(6) ***Cooperation among Cooperatives:*** The cooperative's purpose is to effectively serve its members and to strengthen the cooperative through collaboration with other local, national, regional, and international organisations.

(7) ***Concern for Community:*** Cooperative members work with communities in approving policies for sustainable development of the communities.

It is important to understand that the definitions of the cooperative entity will differ in each country as they are subject to legal policies and structures of that specific country which defines the regulations within which it operates.

Other key aspects regarding cooperatives is that they are not necessarily driven towards profits[95], but rather to create value for their customers which gives the cooperative its unique character that is defined by its values and principles. The cooperative also has a flexible business model whereby different legal structures can be used to achieve a common goal set and controlled by the cooperative's members.

[95] Cooperative Group Limited, 2014. Wide Movement. [Online] Available at http://www.co-operative.coop/corporate/widermovement/ [Accessed on 13 August 2014].

5.4.1.2. TYPOLOGY OF COOPERATIVE MODELS

The typology of cooperative models can mainly be distinguished by four components, namely, the degree of formality, the type of activity, cooperative hierarchy (levels), and ownership. These four components will be discussed below in more detail.

5.4.1.2.1. DEGREE OF FORMALITY

The different types of activity, cooperative hierarchy and ownership rights all form an essential part of the degree of formality of a cooperative. This is further differentiated by the degree of implementation of the cooperatives that depicts the degree of formality, as described below (Tamana, 2005):

- The cooperative principles are used by an informal group, for example, the creation of informal '*stokvels'* and traditional agricultural farming in countries such as China.
- Pre-cooperatives, which are a semi-formal group, that created the initiative for a common purpose or objective. Most traditional cooperatives, pre-cooperatives or pre-forms of cooperatives were not necessarily formed because of their legal structure, but because of their sociological structure (Gosselin, 1976, p. 67). If successful, these semi-formal cooperatives scale into formally registered cooperatives, but this modernisation is not necessarily the case.
- Lastly, there are fully-fledged cooperatives that are legally registered within a specific country and usually are actively promoting the principles of cooperatives as established and governed by the laws of that country.

For the purpose of this research study, fully-fledged and legally registered cooperatives will only be considered in the development of the conceptual framework. This also requires that cooperatives' legal structure needs to specifically relate to South Africa.

5.4.1.2.2. TYPE OF ACTIVITY

There exist numerous cooperative types in the world that can be formed for individuals, businesses or communities. In an attempt to categorise these different cooperative types, six generic cooperative types[96] were considered. The six generic cooperative types are namely, financing-, consumer-, producer-, worker-, purchasing/shared services-, and hybrid cooperatives. They are described as follows:

- **Financing Cooperatives:** This cooperative generally financially supports frugality and cost saving among its members with the aim of creating a fund(s). The fund is then used to invest in its members (often as microfinancing or loan credit) in order to enable its members for provident and productive purposes.

[96] These cooperative types were categorised using different sources, but mainly the Coop Trade [Online] Available at http://www.cooptrade.net/resources/basic/ [Accessed on 20 August 2014], and Tamana (2005).

- **Consumer Owned/Consumers Cooperatives:** The members that buy consumable goods/commodities or use the services offered by the cooperative with the main purpose being procurement and distribution of consumable goods/commodities or services to non-members and members own this cooperative type. Examples include childcare coops, credit union coops, food coops, healthcare coops and housing coops.
- **Producer Owned/Producers Cooperatives:** Producers, usually agricultural industrial and craft inventors own this cooperative type, that jointly undertake production processing and/or marketing of their products. This cooperative usually also involves shared services whereby members are businesses that collectively join with the goal of improving performances and competitiveness. The most common example is agricultural farmers within an industry whereby the processors dictate the price for crops paid.
- **Worker Owned/Services Cooperatives:** Cooperatives that are owned and governed by employees and operate in a specific industry. The main purpose of this cooperative is to provide employees with employment and ownership as an incentive to financially benefit with success of the business/cooperative. Examples of this cooperative industries include childcare coops, communication and technology coops, consumer retail and service coops, hospitalisation coops, insurance coops, housing coops, medical and dental care coops and transport coops.
- **Purchasing/Shared Services/Marketing Cooperatives:** Independent small businesses, government, municipalities or other similar organisations that jointly undertake the supply of production inputs and marketing of products usually own this cooperative type. The collective pooling enhances purchasing power for goods and services, ultimately reducing operation costs and improving adaptability to changing economic situations. Examples are usually industry related to manufacturing, production or procurement, and are similar to producer cooperatives, but can be seen as the extending the services to members.
- **Hybrid/Multipurpose Cooperatives:** This type of cooperative combines two or more types with different business activities whereby its members have a common interest and purpose. For example, a multi-stakeholder hybrid model seeking balance between conflicting needs such as consumers and producers.
- **Social Cooperatives:** This cooperative type involves associated members providing services and/or goods for a social purpose beyond the necessary needs of the associated members. Ownership and governance are usually by workers and/or consumer members in a local community, or the cooperative can have a not-for-profit social purpose. Examples include improving working conditions for disadvantaged communities or providing alternative and affordable healthcare services to a community.

5.4.1.2.3. COOPERATIVE MEMBER TYPES AND HIERARCHY STRUCTURE

Cooperatives' organisational structure generally consists of four principle parties, each with different roles in the operations of the cooperative. These four principal parties for the cooperative are namely, members, employees, management and board of directors. The employees, managers and directors have specific roles in coordinating, administrating, managing and advising the cooperative in service to its members.

Cooperatives generally have two types of members, which are regular and associated members (note different classification per country legislation). Regular members are fully entitled to all the rights and privileges as governed by the cooperative's principles and the particular cooperative's legislation per country. Associated members are not fully entitled and usually restricted, or have no voting privileges depending on the specific country. In some countries, laboratory cooperatives include cooperatives organised and managed by members that are regarded as minors, but these are very country-specific regulations.

The membership rights and privileges are additionally differentiated by the level of hierarchy structures cooperatives can be categorised in. The levels of hierarchy structures are defined as primary cooperatives, secondary cooperatives and tertiary cooperatives. The members between the levels of hierarchy are illustrated in Figure 5.27 below and described as follows (Tamana, 2005):

- **Primary Cooperatives:** Are formed with a minimum of five natural people/individuals becoming the direct members. The main purpose of this cooperative level is to provide employment and/or services directly and to facilitate the development of the community.
- **Secondary Cooperatives:** Are formed with two or more primary cooperatives as the direct members. The main purpose of this cooperative level is to provide sectoral services directly to its members that can include legal or juristic service individuals.
- **Tertiary Cooperatives:** Are formed with two or more primary and/or secondary cooperatives as the direct members. They are also referred to as a cooperative apex and its main purpose is to advocate and engage with public, private and social stakeholders on behalf of its members.

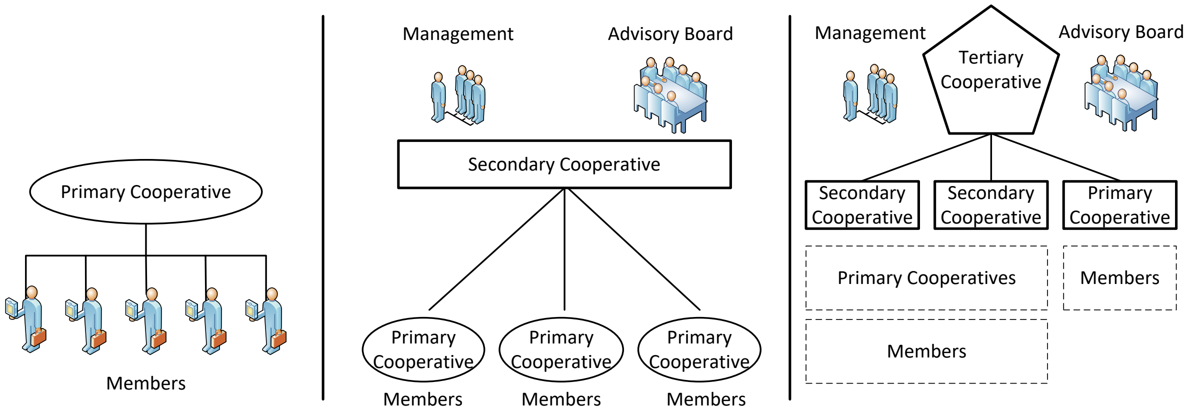


Figure 5.27: Levels of Hierarchy Structure for Cooperatives

The structuring of cooperatives can be design-based on economic and geographic perspectives. Using the different levels that government can geographically disperse as an example, the cooperative structuring could be diversely structured. The local level would be organised by government municipalities, the regional level by districts or metropolitans, the provincial by a number of districts or metropolitans, the national level by the provinces, and the international level by the national level cooperative movements. It is important to understanding certain operational guidelines for the implementation of the cooperative structure. The key important operational aspects to consider are:

- The capital formation and/or investment of the cooperative. Also at the different levels.
- The trading of cash between the different levels.
- Product/Service mark-up and selling prices at the different levels.
- Developing constructive competition and avoiding destructive competition.
- Enable constant growth and expansion of member base.
- Ensure quality standardisation practices of goods and services.
- Cooperative financial model e.g. wholesale or lending (bank).
- Minimise the cost of doing business and expenditures of producing goods and services.

5.4.1.2.4. OWNERSHIP RIGHTS TYPOLOGY AND DIFFERENT COOPERATIVE MODELS

In discussing the topic of ownership, Chaddad & Cook (2004) argue that there are two distinct concepts that must first be explained, namely, residual return and residual control rights. Residual return is the right to have a claim to the net income that was generated by the business, i.e. the residual claimants have a claim to the net income/profit after all expenses, overheads, tax, etc. (fixed claim holders) was deducted. These ‘owners’ or shareholders of the business are the risk bearers of the business and are the residual claimants (Fama, 1980; Fama & Jensen, 1983), but for cashflow purposes and continued growth of the business, only a portion of the net income will at times be taken, usually in the form of dividends.

The residual rights of control emerged based on the incomplete contract theory whereby the unavoidable incomplete contract over assets are defined as who ‘owns’ it and thus, this assignment of control rights or ownership is “*dictated by the ex-ante investment incentives of the contracting parties*” (Grossman & Hart, 1986; Chaddad & Cook, 2004). This means that ownership lies with the shareholders taking the risk of investing in assets and assigning of contracts. In Table 5.9 below, an ownership comparison between different organisational forms is discussed, specifically looking at open corporations, proprietorships, financial mutual and traditional cooperatives.

Table 5.9: Ownership Comparison between Different Organisational Forms adapted from Chaddad & Cook (2004, p. 351)

Organisational Form:	Open Corporation	Proprietorship	Financial Mutual	Traditional Cooperative
Assignment of Residual Returns	To Investors	To Proprietorship	To Customers	To Members
Separation of Ownership from Other Functions	Yes	No	No	No
Control Rights	Voting rights proportional to shareholding.	Proprietor possesses all control rights.	Customers have no control rights.	Non-proportional voting rights (i.e. each member, one vote).
Prospect of Residual Claims	Unlimited	As long as a proprietor.	As long as a customer.	As long as a member.
Transferability of Residual Claims	Yes	No	No	No
Redeemability of Residual Claims	No	No	Yes, on customer demand.	Yes, but at Board's discretion.

In discussing more specifically the alternative cooperative models, Chaddad & Cook (2004) then developed a typology of discrete organisational structures for different cooperative models, based on the broad definitions of ownerships for cooperative members and the property rights theory. The different cooperative models in the typology are differentiated by four main aspects relating to ownership rights namely, restrictions/unrestricted, redeemability/unredeemable and transferable, benefits with regards to returns, and non-conversion or conversion of equity. This typology identified seven cooperative models of which traditional and proportional investment cooperatives are considered polar organisational structures while the other five types are new cooperative models. This typology is illustrated in Figure 5.28 below and described as follows (Chaddad & Cook, 2004):

- **Traditional Cooperatives:** These are defined as cooperatives with property rights attributes that include ownership rights being restricted to members only, with residual return rights being non-appreciable, non-transferable and redeemable; and member benefits distributed in proportion to benefaction. Vitaliano (1983), Staatz (1987) & Cook (1995) argue that this vague property rights structure is subsequently subject to governance and investment constraints. Nilsson et al. (2009)[97] argue that the increase in size of traditional cooperatives and complexity of business operations dissatisfies members in aspects such as ownership control, financial investment issues, ineffective decision-making and culture. This all causes shrinking of member satisfaction, involvement and trust, which have led to traditional cooperatives becoming somewhat of an endangered species.
- **Proportional Investment Cooperatives:** These are defined as cooperatives with property rights attributes, which includes ownership rights being restricted to members only, with residual return rights being non-appreciable, non-transferable and redeemable; and members are expected to contribute investment capital in the cooperative in proportion to benefaction. Royer (1992) and Cook

[97] Nilsson *et al.* (2009, p.103) summarises the different problems to traditional cooperatives found in literature.

(1995) argues for the adoption strategies of capital management policies that ensures capital generated internally as a capital acquisition strategy for traditional cooperatives. The role of the capital management policies is for proportionality strategies whereby members contribute equity capital to usage proportionality. The policies can include narrowing scope of products, separate pools, base capital plans and capital acquisition on business units.

- **Member-Investor Cooperatives:** These are defined as cooperatives with property rights attributes which includes ownership rights being restricted to members only, with residual return rights being non-transferable and redeemable; and member returns are distributed in proportion to shareholding in addition to benefaction. The member's returns are distributed through dividends to shareholding proportion and/or appreciation of cooperative shares, which are all governed by set policies. This cooperative model is implemented through one of the following means:
    - **Participation Units:** These are defined as ownership rights that are non-voting, non-transferable, redeemable and appreciable whereby it is the board's responsibility to set and manage the value of the participation shares each year. Capital acquisition can also usually be raised through means of subsidiary bonds and per unit recollections.
    - **Cooperative Capital Units:** These are defined as a capital acquisition model whereby additional risk capital is raised from members. The model involves member subscription on a voluntary basis, proportionate to performance output. The more modern financial model includes a hybrid debt-equity funding arrangement and provides non-cumulative fixed interest rates, and any bonus interest is paid as a priority over benefaction distributed to members.
    - **Redeemable Preference Shares:** These are defined as ownership rights whereby shares are non-voting, non-transferable and redeemable, as well as interest bearing. Additional to allowing regular issuing of bonus shares that generate capital appreciation, dividends are paid to remunerate members' preference shares capital contribution and opportunity cost thereof. The incentives for members can be summarised as regular bonus issues with investment in redeemable preference shares, the payment of dividends, and remuneration of shares upon exiting. Another version of the model can include a '*valuer*' who is appointed by the board to determine the business valuation ('fair value') when the business exits or whereby new members can purchase a proportion of the business shares at 'fair value'.
- **New Generation Cooperatives:** These are defined as cooperatives with property rights attributes that include ownership rights being restricted to a closed membership group, with residual return rights being appreciable, non-redeemable and transferable. The purpose of transferable equity shares is to provide capital appreciation and liquidity through valuation of secondary markets. Members are expected to provide an initial investment for proportional rights to benefaction and controlled supply by marketing agreements. To summarise, this model relaxes residual claims compared to traditional cooperatives, but maintains member ownership principles.
- **Cooperatives with Capital-Seeking Entities:** These are defined as cooperatives with property rights attributes that include ownership rights being unrestricted to just members and outside capital seeking

entities. With the equity being outside and non-conversional, separate legal entities are used to acquire capital for the cooperative which can include:

- **Strategic Alliances:** A non-traditional option to acquire a permanent source of equity capital with various non-member partners. This allows indirect access to external markets and sources of risk capital in return for shared control and net margins that can be structured as non-controlling joint ventures.
- **Trust Companies:** Can be established by the cooperative as a non-operating separate entity (e.g. trust) as a financing instrument with the purpose of acquiring risk capital from non-members. The external capital used can be for exiting equities and/or new investment projects whereby a return on investment is offered.
- **Subsidiaries:** Can be established as a form of restructuring to obtain non-member capital through the transferring of assets to a separate public limited company. This will be a transfer in equity for the cooperative while the public limited company can acquire external risk capital from investors for the exchange of equity and sometimes profit margins as return on investments.

- **Investor-Share Cooperatives:** These are defined as cooperatives that acquire non-member equity capital through issuing a separate class of equity shares in addition to the traditional cooperative ownership rights held by its members. Different ownership rights 'bundles' are created which include aspects such as returns, control, redeemability, transferability and risk bearing. An investor shares 'bundle' would include non-voting common stock, preferred stock and a participation certificate.
    - **Preferred stock:** These are ownership rights that are non-voting, non-redeemable and fixed dividends.
    - **Non-voting common stock:** Members' equity is converted to nonvoting common stock during an 'in-house' trading period and are subsequently Public listed on a stock exchange whereby investors can trade and in so doing capitalise the cooperatives. Additionally, non-appreciable, non-transferable, voting shares are kept by cooperative members, whereby members maintain voting rights.
    - **Investor participation shares:** Whereby external investors (non-members) can invest in cooperative societies through investor participation shares, bonds and investment certificates.
- **Conversion to Investor-Oriented Firm:** These are defined as cooperatives with unrestricted member's property rights attributes allowing the conversion or 'demutualisation' of the cooperation. Conversion is the process whereby the ownership structure in terms of member-owned and organisation control rights in a cooperative are transformed to a for-profit, proprietary organisation. This process is achieved through reassigning and converting the control rights and residual claim of members to unrestricted common stock with specific ownership rights within the corporate organisation. Public listing whereby the company can capitalise through additional risk capital from investors typically follows the conversion process. This is becoming increasingly more popular since the 1980s for cooperatives in

many industries such as financial exchanges, savings and loan associations, insurance companies, and professional services partnerships, and also includes public listing stock markets.

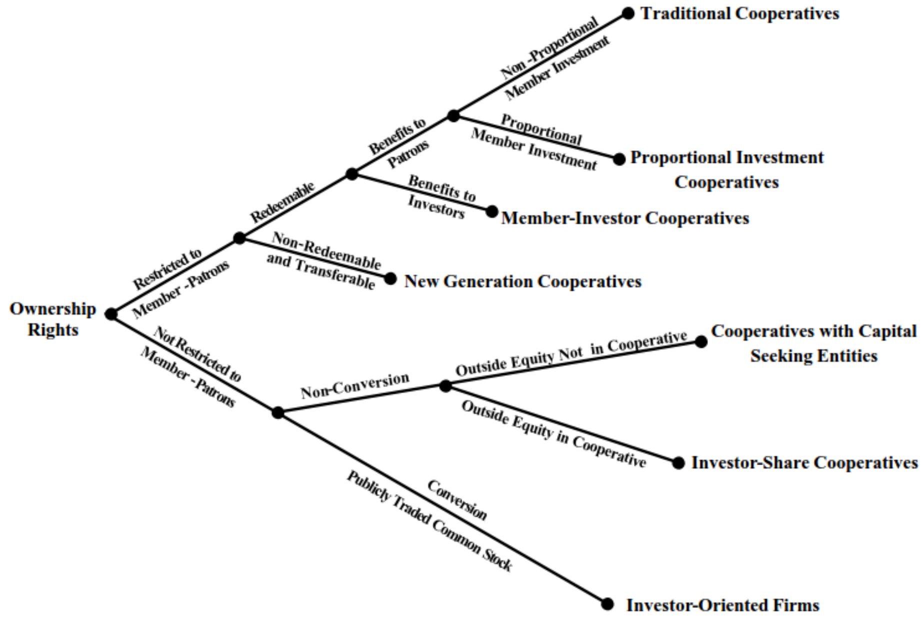


Figure 5.28: Alternative Cooperative Models adopted from Chaddad & Cook (2004)

5.4.1.3. COOPERATIVES GLOBAL COMPETITIVENESS

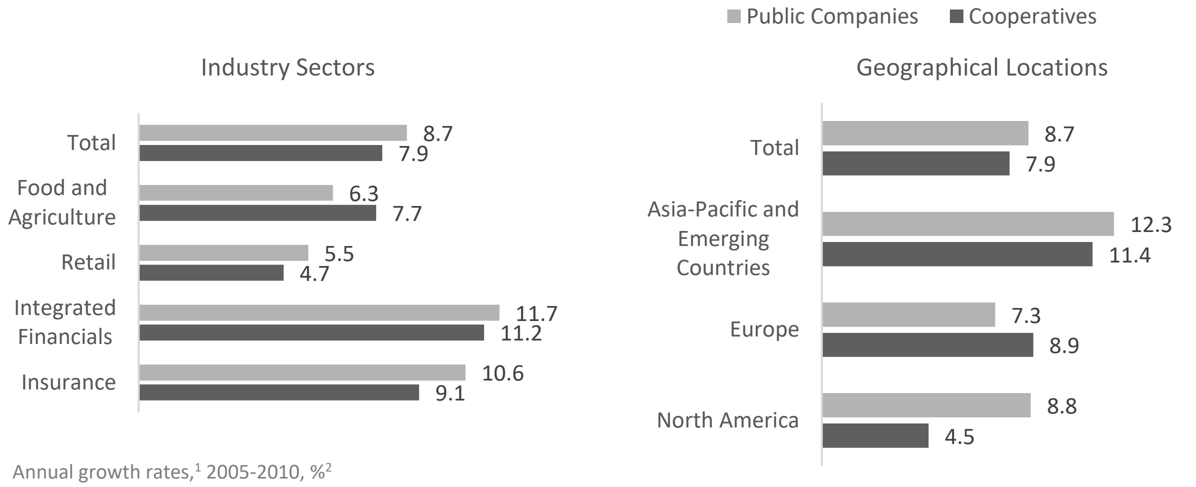
It is estimated in the Worldwide Study of Cooperatives[98] that cooperatives account for more than 1 billion members and more than 100 million employment opportunities. According to a comparison analysis by Berube *et al.* (2012), 47 cooperatives have been found to grow at a similar rate to the 54 publicly listed companies of similar industry sectors and geographical locations. This is illustrated in Figure 5.29 and Figure 5.30 below, where cooperatives were compared on the basis of annual growth rates to different industry sectors, geographical locations and overall.

While the overall comparison is not a complete data set representing a global comparison, it is a strong foundation for valid findings. The overall comparison was based on three drivers, namely, market share gained, portfolio momentum, and mergers and acquisitions. The first two drivers account for organic growth of the organisations as market share is increased and the portfolio effect through different business market segment growth (e.g. entering new market segments with high growth potential) (Berube, et al., 2012). The third driver accounts for inorganic growth through growth strategies involving mergers and acquisitions.

The growth pattern of cooperatives per industry sector and geographical location indicates their competitiveness and that cooperatives are comparable to their public counterparts (refer to Figure 5.29). The interesting aspect about the cooperative growth pattern is the greater market share while public companies

[98] More information on UN DESA's Division for Social Policy and Development (DSPD), 2013. *Worldwide Study of Cooperatives*. [Online] Available at http://www.un.org/en/development/desa/news/social/cooperatives-2.html [Accessed 30 October 2014].

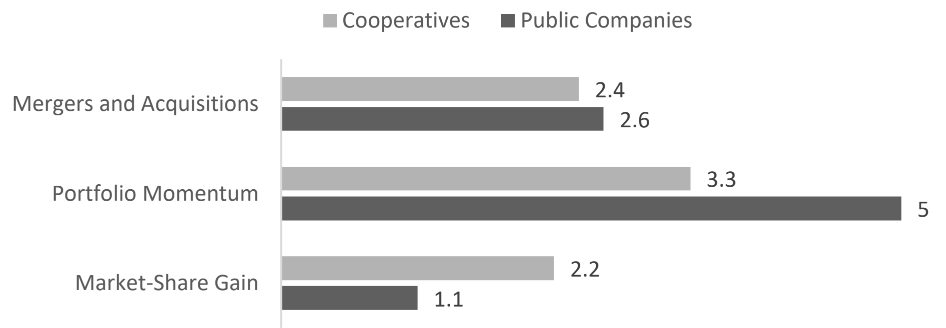
clearly are more favourable in differentiating their business model. This is mainly because cooperatives serve their members' needs and generally have a better proximity and knowledge of their market (Berube, et al., 2012).



Annual growth rates,[1] 2005-2010, %[2]
Notes: [1] Analysis based on 47 cooperatives and 54 publicly listed companies.
[2] Considering sample size and availability of data, growth numbers are within 1% confidence interval 75% of the time.

Figure 5.29: Comparing Different Industry Sectors and Geographical Growth Rates between Cooperatives and Publicly Listed Companies adapted from Berube *et al.* (2012, p. 5)

The clear issue in comparison is the weaker portfolio momentum driver of cooperatives and can be reasoned to be based on two aspects, namely, the purpose of cooperatives and the restrictions in governance structure. The cooperative purpose, as mentioned, is more focused on serving its members' needs rather than innovating new products or services to exploit new market segments. The second reason is that cooperatives' governance structure is fundamentally based on democracy and consensus rather than executive decision-making.



Annual growth rates 2005-2010, %[1]
Notes: [1] Considering sample size and availability of data, growth numbers are within 1% confidence interval 75% of the time.

Figure 5.30: Overall Comparison between Cooperatives and Public Companies adapted from Berube *et al.* (2012, p. 6)

5.4.1.4. COOPERATIVES, SOCIAL DEVELOPMENT AND ENTRERPRENEURSHIP

Seeing that cooperatives are member-owned, member-run and/or member-serving businesses, they empower collective realisation of economic aspirations, while supporting the development of communities through the strengthening of individual member's social and human capital.

It is clear that cooperatives play a vital role in social and economic development, while the United Nations (1995)[99] has found that cooperatives have the potential, if utilised and developed fully, to contribute in the following ways:

- **Reduction of Poverty:** Cooperatives provide communities with a self-help organisation to eradicate poverty through social and economic progress created by members and employees. This enhances the social fabric through organisation operations and stimulates economic growth.
- **Generation of Employment:** Cooperatives support the creation, improvement and protection of members' income, as well as providing members with employment opportunities. Through the pooling of limited individual resources of the members and additional support, cooperatives enable the creation of business opportunities whereby members can participate in cost-saving, production, profit sharing and risk-taking (different cooperative models discussed above).
- **Social Integration:** Cooperatives addresses challenges, inequalities and gaps in society through promoting social cohesion and integration. This is achieved through collaboration and alliances between the society members.
- **Globalisation Impact:** Cooperatives fundamentally promote inclusivity, sustainability and a people-centred approach to creating business entities seizing global opportunities. Globalisation enables access to markets and opportunities through essentially creating a business pipeline to capture them.

In literature, the understanding for creating cooperation in social and economic development has made thorough progress, but understanding the role of entrepreneurship is often overlooked. Diaz-Foncea & Marcuello (2013) argue that the role of entrepreneurship is to act as a driver in cooperative organisations. In Table 10 below, different characteristics of the different entrepreneurial types are discussed that are associated with cooperatives.

Essentially entrepreneurs, regardless of the type or field, aspire to take on challenges to solve challenging problem(s) and/or provide for market need(s), and incentives from financial benefits. The nature of entrepreneurship differs based on the process involved depending on industry and services, for example, the different entrepreneurial requirements in overcoming the specific challenges. It is, therefore, not worth defining each type of entrepreneur, but more specifically to look at the role cooperatives play in supporting entrepreneurship. It is noteworthy that cooperatives are not solely limited to cooperative entrepreneurs as all

[99] More information on United Nations, 2014. *Cooperatives*. [Online] Available at http://undesadspd.org/Cooperatives.aspx [Accessed 30 October 2014].

entrepreneurs can utilise a cooperative as a legal entity to do business which are called, entrepreneur cooperatives.

There are mainly two perspectives to discuss when considering entrepreneurial cooperatives, firstly is advantages from individual business economics and secondly is the advantages from regional or national economies.

5.4.1.4.1. ADVANTAGES INDIVIDUAL BUSINESS ECONOMICS

Göler von Ravensburg (2009) argues that entrepreneur cooperatives as a legally registered cooperative supporting small and start-up businesses is usually motivated by the improvement of one's own economic situation. Cooperatives should aim to meet members' expectations through supplying effective and efficient services and products (Hanel, 1992, p. 58), while offering more supportive conditions in terms of access to markets, developing projects or public institutions, than it is possible to be obtained/produced individually (Röpke, 1992, p. 41).

In Table 5.10 below, Göler von Ravensburg (2009) lists numerous featured services and their associated advantages that entrepreneurial cooperatives could offer and also argues that cooperatives should pursue the interests of its members (e.g. cost reduction and innovation) and charge accordingly. Initially, entrepreneurial cooperatives will be limited in the business services offered and often start off by offering only one service (Crooks, et al., 1995). As cooperatives mature, they should consider diversifying and creating more complex ownership and governance structures, and eventually also consider establishing financial investment networks and/or second tier structures (e.g. secondary and/or tertiary cooperatives) (Göler von Ravensburg, 2009).

The individual business economics of an entrepreneurial cooperative incentivises its members involved in sharing the risks and gains whereby contractual relationships are established and once operations run successfully, members obtain respective transactions' share of surpluses achieved and share capital (Göler von Ravensburg, 2009). Entrepreneur cooperatives can also potentially generate transaction costs among members through building trust and interdependencies ('social capital') (CEC, 2001, p. 9). Additionally, cooperatives can reduce information, knowledge and learning costs between member businesses and markets (Grosskopf, 1994).

The effect of the entrepreneur cooperative also produces a number of specific direct economic and socio-economic advantages for its members (Göler von Ravensburg, 2009):

- Increase in diversity and/or volumes of productions;
- Improved capital and labour productivity with increased production;
- Improved effect on employment and produces higher employment incomes;
- Improved company size as compared to the informal and from small and medium business sector;
- Improved access and utilisation of local resources;
- Creation and diffusion of innovation;

- Increased knowledge and learning of members (e.g. cost of market searches and contract screening);
- Improved risk management;
- Reduction of costs of doing business improving creditworthiness and providing new investment opportunities;
- Infrastructure development investment opportunities;
- Local government support efforts in allocating and distributing of resources.

Table 5.10: Featured Services of an Entrepreneurial Cooperative adapted from Göler von Ravensburg (2009)

Featured Services	Advantages
Supplies of raw materials or commodities	*Usually at a lower costs than would be available to individuals.*
Plant and machinery supplies	*Usually at a lower costs than would be available to individuals.*
Purchase of machinery and equipment shared among members	*The investment costs of which would be prohibitive to individual member enterprise.*
Storage of products	*Smoothing of prices and reduced service fees.*
Marketing and distribution	*Economies of scale and scope.*
Publicity and promotion	*Reputation and visibility.*
Creating brand names and marketing	*Increased public recognition and eventually market share.*
Setting and certifying of quality standards	*Operation in new markets.*
Information on products, production and sector	*Product design and production planning improved.*
Education and training	*Management and production skills enhanced.*
Insurance services	*Cheaper and more appropriate risk coverage.*
Accountancy/financial and other management services	*Concentration on key business areas.*
Legal and tax services	*Concentration on key business areas.*
Investment	*Improved financial management.*
Advising members (tax and legal advice, management advice, among others)	*Enhanced strategic decision-making.*
Market analysis and strategic planning	*Enhanced strategic decision-making.*
Risk cover	*Innovation becomes easier*

5.4.1.4.2. ADVANTAGES FROM REGIONAL OR NATIONAL ECONOMIES

Entrepreneur cooperatives are also not limited to produce advantages solely to its members, but have indirect economic and socio-economic advantages. These advantages are briefly discussed above as identified by the United Nations, and their potential impact includes employment generation, poverty reduction, social integration and empowerment of disadvantaged groups. The potential to create employment is resultant to the following aspects (Göler von Ravensburg, 2009):

- Utilising of economies of scale and scope;
- Improved bargaining power by individual member businesses;
- Improved and active participation by members;
- Continuous improved membership and production value through representation of member interests, legal protection, organisation stability and innovation.

The potential socio-economic advantages include the following aspects (Göler von Ravensburg, 2009):

- Building capacity within the community;
- Improved access to information, knowledge and learning;
- Improved access to open markets including exporting to different regional, national and international markets;
- Improved social capital through the recognition and establishment of existing and new social relationship/networks;
- Increase control and use in the protection of natural resources;
- Pooling of knowledge expertise through education, collaboration and training;
- Pooling of local resources to improve effective control and use;
- Preventing rural-urban migration through increased support by diversifying the rural community's economy;
- Providing services previously offered only by government;
- Providing a defence against capital crisis in the case of natural disasters, financial downturns, etc.;
- Providing an alternative and/or increased income streams that contribute to the abolition of child and bonded labour.

In this research study, the emphasis is merely on the two major considerations cooperatives influence: the decision-making and governance by entrepreneurs (Diaz-Foncea & Marcuello, 2013). Firstly, the basic characteristics of cooperatives are mutual benefits, equal distribution, collective governance and participation. Secondly, forming of entrepreneurial teams with group-appointed leadership instead of '*lone wolf*' entrepreneurs. It will also focus on entrepreneurial cooperatives with its apparent advantages in developing an ecosystem and pipeline supporting innovation, especially when compared to its traditional counterparts.

5.4.1.5. COOPERATIVE GROWTH CHALLENGES & OPPORTUNITIES

In theory, cooperatives seem to present a convincing case as an organisational structure, but what are the challenges and future growth opportunities to improve the effectiveness of cooperatives? Berube *et al.* (2012) conducted an Organisation Health Index (OHI) analysis aimed at identifying challenges and growth opportunities for cooperatives. The OHI consists of three main drivers (alignment, execution and renewal) which are further divided into leadership, direction, culture and climate (alignment), motivation, accountability, coordination and control, capabilities (execution), external orientation, and innovation and learning (renewal).

Berube *et al.* (2012) found from cooperative and publicly listed companies that cooperatives are powerful models for alignment as well as motivation and accountability. However, their ability to respond to business changes and market opportunities remains a lacking dimension. This can then relate to three main challenges with agility in decision-making, pursuing new opportunities and developing and sourcing talent. However, some suggestions on improving the agility to solve these challenges are listed in Table 5.11 below (Berube, et al., 2012, and Nixon, 2012).

Table 5.11: Suggestions to Improving Components to Overcome Key Challenges in Cooperatives (Berube, et al., 2012, and Nixon, 2012)

Improvement Component	Suggestion to Overcoming Challenge
Improving agility in decision-making.	Distinguishing different executives and management respective roles and responsibilities clearly.
	Create and manage clear and efficient processes to discuss strategic issues and relevant aspects with members (maintain democratic component).
	Enable and improve the speed of identification and adjustments to components under pressure through improving the performance management process and systems (e.g. key performance indicators).
Improving agility in pursuing new opportunities.	Through exposing the cooperative to an increasing number of perspectives, ideas and opportunities (e.g. knowledge networks).
	Through explicitly exposing different organisational components and processes in a collaborative and co-working space(s), to improve knowledge sharing and transferring.
	Develop capital financing structures to fund emerging opportunities that can potentially benefit the member-base in the longer run rather than immediately.
Improving agility in developing and sourcing talent.	Through improving the identification process of identifying promising and top talent, as well as creating leadership development tracks (e.g. continuous education or professional development).
	Adopt change management practices through recruiting human resource management practices (e.g. recruiting and training) to adapt the paradigm between working in a cooperative versus a public company.

In the literature review, it was found that cooperatives face numerous other high-level challenges. These challenges are arranged according to the three key challenges (decision-making, pursuing new opportunities, and developing and sourcing talent) which are listed in Table 5.12 below. For the purpose of this research study, only the brief highlights of these challenges will be mentioned.

Table 5.12: List of Additional Cooperatives Challenges

	Additional Challenge	Notes	Author
Decision-Making	Cooperative Directors	Cooperative-based decisions; Managing of the directors' conflict of interests; Managing financial matters; Board-management relations; Balancing of members' interests; Assessing the cooperative's success.	Baarda (2002), Cheney *et al.* (2014)
	Political Culture	Government-controlled versus Liberated Cooperative Development. Effective management of regulatory policies and legislation to promote effective cooperative development.	Develtere *et al.* (2008), Wanyama *et al.* (2009), Wanyama (2012)
	Social Culture and Market Demands	Social capital and control are important for maintaining the values and principles of the cooperative while managing the operations to meet market demands.	Wanyama (2012), Cheney *et al*. (2014)
	Scaling of Cooperative Administration	Large and complex cooperatives scale operations to cater for market needs, but cause member dissatisfaction, low involvement and mistrust in the leadership.	Nilsson *et al.* (2009), Cheney *et al*. (2014)
Pursuing New Opportunities	Government Support and Role of Philanthropy	Poor financial base despite government financial support. Governments are required to provide the regulatory environment that provides the unique support services aligned with the cooperative's business needs	Wanyama (2012)
	Funding and Investors	Regulatory system that allows for flexibility in investing in cooperatives for financial return. Creating hybrid cooperatives or new generation cooperatives.	Battilani & Schröter (2011)
Developing and Sourcing Talent	Membership Participation	Effective motivation and support for membership participation in the cooperatives is essential for developing capacity.	Wanyama (2012)
	Leadership Roles	Requires an interplay with different forms of leadership (e.g. from charismatic to ethical to collaborative).	Cheney *et al*. (2014)
	Demutualisation	Changes to cooperative organisational structures to adapt to global challenges as cooperatives prefer conversion or demutualisation to hybridisation.	Battilani & Schröter (2011)

5.4.2. COOPERATIVES EMERGING IN DEVELOPING AFRICA AND SOUTH AFRICA

This section will discuss what existing trends and challenges are found in South African cooperatives, as well as the general role of cooperatives in Africa. It will also look at the general legislation governing cooperatives in South Africa. The aim is to give a brief overview of cooperatives in Africa and more specifically in South Africa.

5.4.2.1. COOPERATIVE MOVEMENT EMERGING IN AFRICA

Research by Wanyama (2012) extensively discusses the history of cooperative development in Africa and the transition in the cooperative movement. According to Develtere *et al.* (2008), the total number of cooperatives is continuing to grow in most countries, while it is estimated that 7 out of 100 Africans are members of a cooperative.

Wanyama *et al.* (2009) defined Africa's cooperative movement as having two major eras, the first era accounts for the post-colonial period from the 1960s to the mid-1990s where cooperatives were state-controlled. The second era accounts for the period from the mid-1990s to the present where cooperatives were liberated from excessive government control and cooperative development has become more flexible in its value proposition to members.

This transition in the cooperative movement has resulted in numerous specific challenges to the cooperative development in African countries which include the following:

- Some countries are still excessively regulated by government controlled and governance over the cooperative development while others have a sudden change in government regulation with no alternative regulatory mechanisms supporting cooperative development in this transition.
- Cooperatives are also often used through authoritarian policies and legislation under a specific political culture to prosper a certain political patronage whereby the focus is misguided onto the political culture instead of motivating membership participation.
- A lack of effective motivation and support for membership participation in cooperatives, which is a significant detriment to cooperative development. The solution of membership participation requires both a bottom-up and top-down approach. It is a function of aligning the people's interests with the provisional services required while the political culture needs to embrace the democratic regulatory support for cooperative development.
- Another significant detriment to cooperative development is a poor financial base, despite government directed financial support. This requires governments to provide the regulatory environment that provides the unique support services aligned with the cooperative's business needs. This will allow the freedom for cooperatives to operate as their counterparts that enable capitalisation from a wider financial base that is not solely reliant on government support. Ultimately, with a wider financial basis, cooperatives can provide additional services to their members.

These challenges are not solely common to African countries, but also apply globally in countries in transitioning governments and emerging economies. Essentially, cooperatives can be market equals to publicly listed companies (as in European countries), if the same amount of support is provided to cooperatives as to public listed companies.

5.4.2.2. COOPERATIVES IN SOUTH AFRICA

In South Africa, the government has recognised the need to promote cooperative development through recently adapting necessary political, regulatory changes through the establishment of financial support programmes and other strategic support programmes[100]. These changes in legislation occurred through the Cooperative Act 14 of 2005 that recognised the following key changes (Ortmann & King, 2007):

- The values of cooperatives should include democracy, equality, self-help, self-reliance, self-responsibility and social responsibility;
- The cooperative movement's major role be economic and social development specifically focusing on creating employment, generating additional revenue/income streams, eradicating poverty and facilitating broad-based black economic empowerment (BEEE);
- The economy of South Africa is boosted by an increased number and diversity of sustainable and viable cooperatives;
- A supportive legal environment is provided by a committed government aiming to enable cooperative development.

In a recent census of cooperatives, it is estimated that there is a rapid growth in the number of registrations of cooperatives while the total deregistrations are extremely low leading to a high total number of active cooperatives. These trends in South Africa are illustrated in Figure 5.31 below. However, in the DTI Baseline Report, it was found that there is a high number of inactive cooperatives that are currently not in operation (the DTI, 2012). This could be because of the cooperative incentive structure and lack of coordination and management thereof, as numerous cooperatives are purely formed for financial gain without any vision of actively pursuing the growth of the cooperative in the long run.

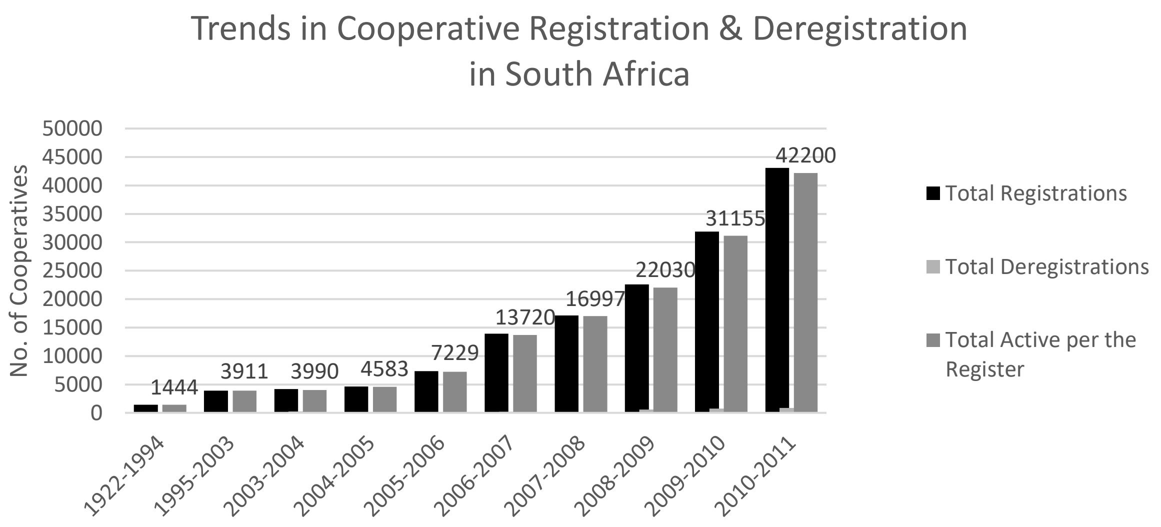


Figure 5.31: Number of Cooperatives in South Africa adapted from the DTI (2012)[101]

The spread of the different sectors of cooperatives is quite wide, with the four most populated sectors being agriculture (23%), services (15%), multipurpose (13%) and trading (11%). These four sectors account for 62% of all cooperatives and can be understood as agricultural cooperatives largely supported by earlier governments of South Africa. The trend of new multipurpose, services and trading cooperatives is a good sign for competitive

[100] *Different strategic support programmes to promote cooperatives in South Africa are discussed by the DTI (2012) on p. 67-83 (also listed in Annexure A on p. 85-91).*

[101] *The data was collected by the DTI (2012) from the Registrar of Co-operatives, Statistics of Co-operatives in South Africa, 1922 – 2012.*

growth in the South African economy. However, there are still numerous challenges that are summarised below in Table 5.13.

Table 5.13: Cooperative Challenges Specific to the Economy of South Africa (the DTI, 2012)

Challenge Role Players	Specific Cooperative Challenge
Government Challenges	Inadequate economic and social impact statistics on cooperatives.
	More effective and adequate coordination public sector support.
	Limitation of current support from existing enterprise development agencies for cooperatives.
	Recognition of cooperatives as a unique business form and diversity in public and private market remains very low.
	Accessibility of cooperative registration to local communities.
	Limited promotion and awareness.
	Avoidance of formalisation by informal self-help groups.
	Limited access to finance.
	Limited access to technology.
	Limited access to critical business infrastructure.
Cooperative Organisational Structures Challenges	Lack of strong and viable cooperative associations and organisations.
Cooperative Management Challenges	Poor management and technical skills
	Limited trust and social cohesion
	Democratic decision-making skills within the cooperatives remain low.
	Limited cooperation among cooperatives.
	Appreciation of collective interest above individual interest is still a challenge.
	Embracing self-reliance as a principle within cooperatives remains a challenge.
	Compliance with the cooperative legislation among new cooperatives is still a challenge.
Market Challenges	Undeveloped networks and economic value chains.
	Limited access to markets.

5.4.2.2.1. COOPERATIVE LEGISLATION AND PROMOTION IN SOUTH AFRICA

In South Africa, the specific legal structures that legally registered cooperatives need to adhere to are as follows:

- The Cooperative Act 14 of 2005 provides the information on:
  - the formation and registration of cooperatives;
  - the establishment of the Cooperative Advisory Board (including the administration, management, auditing, and capital structures of cooperatives);
  - the winding up or deregistration (includes amalgamation, division, conversion and transfer of cooperatives);
  - the repeal of Act 91 of 1981 and any other matters connected therewith.
- The Cooperative Amendment Bill 17 of 2012 and the Cooperative Second Amendment Bill 18 of 2012 combined formed the establishment of the Cooperative Amendment Act 6 of 2013.
- The Cooperative Amendment Act 6 of 2013 provides the amendments made to the Cooperative Act 14 of 2005 and key highlights of topics are:

- General amendment and substitution to certain definitions (e.g. Advisory Board Council, Constitution, Cooperative Principles);
- Provided an additional section and the amendment on associate membership of cooperatives, categories for primary cooperatives and national apex cooperative;
- Amendment to the accounting practices and auditing specifics;
- The establishment of a Cooperative Development Agency;
- The establishment of a Cooperative Tribunal for winding up of cooperatives;
- Principles of intergovernmental relations.

There are also financial assistance and incentives from the South African government in support of cooperatives and the establishment thereof. Namely, the DTI Cooperative Incentive Scheme[102] (CIS) is a 100% grant for registered primary cooperatives (consisting of five or more members). Its objective is to improve the viability and competitiveness of cooperatives through lowering the cost of business and providing assistance to acquiring start-up requirements and develop an initial asset base. The CIS specifically looks for activities that support and enable sectors such as business development services; technological improvements; machinery, equipment and tools; commercial vehicles; infrastructure development; and working capital.

5.5. CHAPTER SYNTHESIS

In this chapter, a literature review was conducted on cooperative models and in particular, the state of cooperatives in South Africa. This literature review was conducted also on the best practice and role of different knowledge management models. The objective was to answer the SRQs defined for this chapter as listed in Table 1.1 and includes SRQ:5.1–5.21.

The SRQs answered in this literature review, as well as their outcome and significance, are synthesised in Table 5.14 below. The significance of the answered SRQs is used in Chapter 6 in the development of the conceptual framework while the three objectives of this chapter (refer to Table 1.2) were successfully achieved as follows:

[SRO:5.1] ***Determine the best practices of knowledge management and networks models.***

The SRO:5.1 was achieved as the SRQ:5.1-5.11 was successfully reviewed, and its significance is to support the conceptual framework as knowledge forms the basis for innovation.

[SRO:5.2] ***Determine the best practices of cooperative models.***

[102] The Department of Trade and Industry (DTI), Co-operative Development Financial Assistance (Incentives). [Online] Available at https://www.thedti.gov.za/financial_assistance/financial_incentive.jsp?id=11&subthemeid=3 [Accessed on 20 August 2014].

The SRO:5.2 was achieved as the SRQ:5.12–5.19 was successfully reviewed and it was concluded that cooperatives play a significant role in developing an innovation ecosystem through supporting innovation, entrepreneurship and socio-economic development.

[SRO:5.3] ***Develop an understanding of the dynamics of cooperatives in South Africa.***

The SRO:5.3 was mostly achieved in successfully reviewing SRQ5.20–5.21, in developing an understanding of the state of the cooperative movement in Africa and more particularly in South Africa while a brief review of South Africa's cooperative legislation was also reviewed in support of developing the conceptual framework.

Table 5.14: Synthesis of the Sub-research Questions and the Related Literature Review of Chapter 5

Ref. Code	Sub-research Questions	Related Section	Outcome Achieved	Significance
RSQ:5.1	*What is the definition and role of knowledge management?*	§5.2.2	Yes	**FDC: 4.1** The management of the knowledge are essential to forming the basis of innovation and are required to be taken into consideration in the enterprise innovation process.
RSQ:5.2	*What is the implications and considerations of using knowledge management?*	§5.2.2.1	Yes	
RSQ:5.3	*What are the different knowledge management models and frameworks?*	§5.2.2.2	Yes	
RSQ:5.4	*What is the best practice of knowledge management?*	§5.2.2.2 & §5.3	Yes	
RSQ:5.5	*What is the relationship between innovation and knowledge?*	§5.3.1-3	Yes	**FDC: 4.2** The necessary financial and intellectual capital structures are required to be incorporated into the framework.
RSQ:5.6	*What is the definition of knowledge and intellectual capital?*	§5.2.1	Yes	
RSQ:5.7	*What are the types of knowledge and intellectual capital?*	§5.2.1	Yes	
RSQ:5.8	*What is the definition, role and purpose of integrated knowledge networks?*	§5.3	Yes	**FDC: 4.3** The enterprise innovation process requires the necessary information and knowledge flow provided by knowledge network models.
RSQ:5.9	*What are the different types of knowledge networks?*	§5.3.5	Yes	
RSQ:5.10	*What is the best practice of integrated knowledge networks?*	§5.3.5	Yes	
RSQ:5.11	*How does integrated knowledge network improve the structural performance of an organisation?*	§5.3.3	Yes	

Ref. Code	Sub-research Questions	Related Section	Outcome Achieved	Significance
RSQ:5.12	*What is the definition, role and purpose of a cooperative?*	§5.4.1	Yes	**FDC: 6.1** The organisational structure fit of the framework is required to consider the different types of cooperative activities and models. **FDC: 6.2** The organisational structure fit of the framework is required considered the level of the hierarchy in the cooperative model chosen.
RSQ:5.13	*What are the different types and models of cooperatives?*	§5.4.1.2	Yes	
RSQ:5.14	*What are the advantages and disadvantages of cooperative models?*	§5.4.1.1-4	Yes	
RSQ:5.15	*What are the growth challenges of cooperatives?*	§5.4.1.5	Yes	**FDC: 6.3** The organisational structure and enterprise innovation process are required to mitigate risks through addressing the challenges faced with cooperative structures.
RSQ:5.16	*What are the best practice of cooperatives?*	§5.4.1.2-3	Yes	
RSQ:5.17	*What is the relation between cooperatives and entrepreneurship?*	§5.4.1.4	Yes	**FDC: 6.5** The role of entrepreneurship and enabling business development in cooperatives are to be considered in the development and structuring of the organisational structure of the framework.
RSQ:5.18	*What is the global competitiveness of cooperatives?*	§5.4.1.3	Yes	
RSQ:5.19	*Can a cooperative model be used as a venture capital model?*	§5.4.1.2	Yes	
RSQ:5.20	*What is cooperatives state of cooperatives in Africa and South Africa?*	§5.4.2	Yes	**FDC: 6.4** The legal policy per country regarding cooperatives as a business entity needs to be considered in the structuring and financing of the cooperative.
RSQ:5.21	*What is the legislation of cooperatives in South Africa and other considerations?*	§5.4.2.2.1	Yes	

6 Developing the Conceptual Framework

This chapter defines how the conceptual framework is developed. A specific framework development methodology is created consisting of design criteria from the literature review and an enterprise engineering structural component checklist.

6.1. INTRODUCTION

In this chapter, the building process of the conceptual framework will be discussed in more detail. It will essentially explain design criteria for the development of the framework and the various levers influencing the design of the framework. Mouton (2008) states that the importance of frameworks, models and theories are that science cannot make progress without them as it brings conceptual coherence and simplification to the science domain. According to the Compact Oxford Dictionary, a framework is defined as "*the principal or supporting structure or a set of assumptions, concepts, values and practices that constitutes a way of observing reality*".

The reason for developing a conceptual framework is to take various models and to embody them under a framework. This allows for a conceptual illustration of the organisational structure, the key innovation processes and the value chain of the framework. According to Kappel (2001), Kostoff & Schaller (2001), and Phaal *et al.* (2004), frameworks have developed into accepted structures to represent and illustrate processes, procedures and life cycles. They have also been essential to establishing long-term vision and strategic intent for small and medium businesses to grow as argued by McMahon (1998). For these reasons, developing a conceptual framework sustains the objectives outlined for this research thesis.

6.1.1. SYSTEMATIC DEVELOPMENT PROCESS

This research study uses a systems engineering process[103] that is crucial for the development of the conceptual framework as illustrated in Figure 1.2 in Chapter 1. The overall objective of the systems engineering approach is to achieve the research objectives (refer to Table 1.2) by answering the research questions (refer to Table 1.1). In formulating the process of the framework development methodology, the adapted building process outlined by Kennon (2010) is used and modified into a stepwise process is illustrated in Figure 6.1 and described systematically as:

- **(1)** Define the objectives and key assumptions of the Framework,
- **(2)** Map the fields of concern and categorising the design criteria regarding the Framework;
- **(3)** Define the process and function of the Framework;
- **(4)** Develop the structural requirements and strategic levers influencing the Framework;
- **(5)** Use the CVCF to develop a Cooperative Venture Capital model specific for Stellenbosch University as a case study example;
- **(6)** Validate the developed case study and Framework;
- **(7)** Finalise the Framework with the feedback from the validation.

[103] *Please note, that the systems engineering process illustrated in Figure 2 (p.10) should not be confused with the black box systems engineering and enterprise engineering approach used in developing the CVCF.*

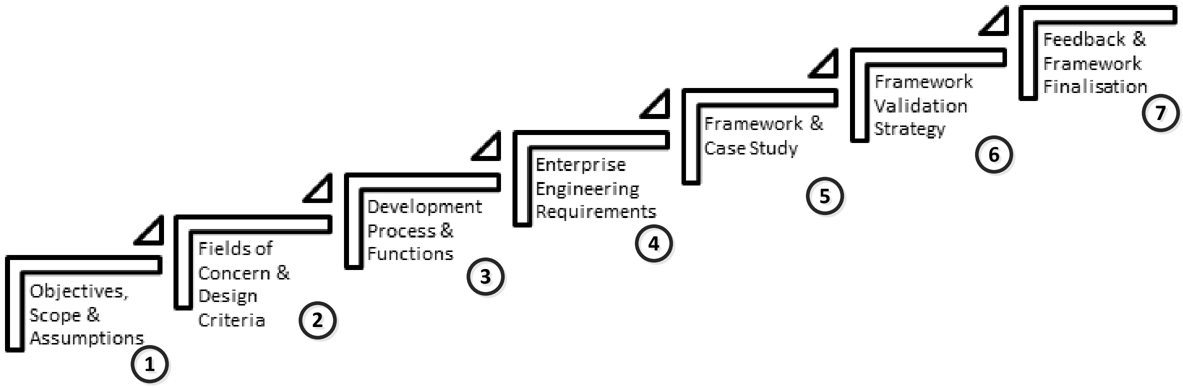


Figure 6.1: The Systematic Process of Developing the Conceptual Framework

The four key steps in developing the Framework are the objectives and key assumptions **(1)**, fields of concern and design criteria **(2)**, developing process and function **(3)**, and structuring of the framework **(4)** will be discussed in this chapter, while steps **(5)** to **(7)** will be completed and discussed in Chapters 7 to 9.

6.1.2. REQUIREMENTS ANALYSIS

In the collated and reviewed literature, the research analysis methodology developed by Schutte (2010) is further adapted as a requirements analysis method specifically for this research. The adaptation will be rooted in the high-level approach followed, as the framework is based on enterprise engineering principles (refer to section 6.5.1 p. 19) and will be the overall requirements checklist of the structure of the framework. While in the requirements analysis, these three components are required in the development of the framework. These three framework requirements are:

- ***Framework Objectives (FR:1.0):*** What is the objective and scope of the Framework? Refer to section 6.2.1 on p. 4.
- ***Design Criteria from the Field of Concerns (FR:2.0):*** What are the design criteria to satisfy the Framework's objectives? Refer to section 6.3.2 on p. 7.
- ***Framework Processes and Functions (FR:3.0):*** What are the process of functionally implementing the objectives of the Framework? Refer to section 6.4 on p. 13.

These high-level requirements are illustrated in Figure 6.2 below whereby each type of requirement is shown in relationship to the other. Each of the levels possesses its own characteristics that are discussed separately in this chapter.

The high-level requirements aim collectively to fulfil the Framework's structural requirements that are based on enterprise engineering principles. In doing so, the Framework will successfully comply as an enterprise engineering structure.

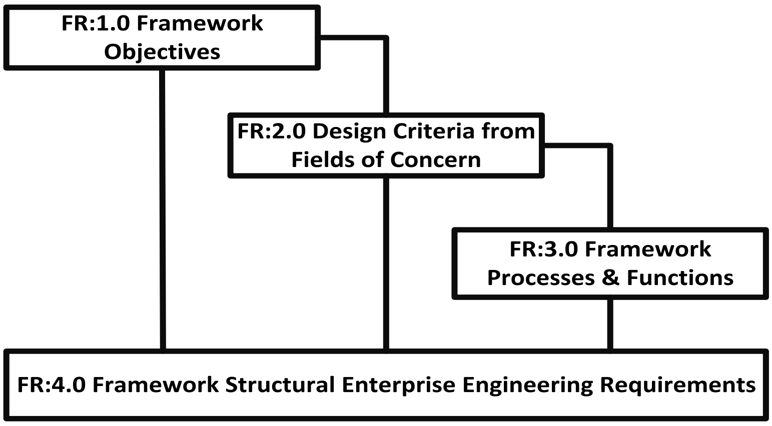


Figure 6.2: High Level Requirements Diagram for the CVCF

6.2. FRAMEWORK OBJECTIVES & KEY ASSUMPTIONS

To fully understand any framework, one must understand the objectives that it aims to achieve. In developing a framework, the framework's objectives are applied within its scope together with its key assumptions. These important aspects combine together forming the ***Framework Objectives (FR:1.0)*** requirement of the CVCF and will be discussed in detail below, while the framework's scope is also defined.

6.2.1. FRAMEWORK OBJECTIVES AND SCOPE

In order to address the complex problem identified in Chapters 1 and 2, the MRQ and MRO needs to be aligned with the conceptual framework that is representing the 'whole solution'. Therefore, the Main Framework Objective (MFO) and the Sub Framework Objectives (SFOs) of the conceptual framework developed based on the MRQ and MRO. The scope of the research is specifically developing the case study as an application example of the CVCF specifically focusing on public funded universities in South Africa.

6.2.1.1. MAIN FRAMEWORK OBJECTIVE

The Main Framework Objective (MFO) for developing the CVCF is as follows:

[MFO]: ***The main objective of the CVCF is to develop an innovation pipeline for an organisation, region or cluster that supports entrepreneurial teams to commercialise their intellectual property or technology.***

This will be achieved by adequately supporting and enabling the sub-framework objectives that are achieved by the framework meeting the design criteria as highlighted in the sections below.

6.2.1.2. SUB-FRAMEWORK OBJECTIVE

The Sub-Framework Objectives (SFOs) for developing the CVCF are described in Table 6.1 below.

Table 6.1: The Sub-Framework Objectives for Developing the CVCF

Ref.	Sub-Framework Objective	Related Chapters	Notes
SFO: 1.0	Develop a framework addressing problems in a given innovation ecosystem with an emphasis on innovation output.	*Chap. 2*	*The innovation ecosystem was extensively discussed and specifically focusing on South Africa.*
SFO: 2.0	Develop a flexible organisational structure supporting entrepreneurial teams.	*Chap. 3; Chap. 5*	*Venture Capital and Cooperative Models as organisational structures.*
SFO: 3.0	Develop a complete innovation process supporting the important phases of the entrepreneurial development.	*Chap. 3; Chap. 4; Chap. 5*	*Innovation models, knowledge network models, lean start-up methodology and strategic fit model.*
SFO: 4.0	Supporting entrepreneurial teams throughout the innovation value chain.	*Chap. 2; Chap. 3; Chap. 4;*	*Entrepreneurial ecosystem and its respective value chain support entrepreneurial teams with available resources and infrastructure.*
SFO: 5.0	Mitigate risk factors and implement success factors.	*Chap. 4*	*Start-up business growth challenges.*
SFO: 6.0	The framework should develop a specific cooperative venture capital model for the defined purpose.	-	*Outcome of the framework.*

6.2.1.3. FRAMEWORK SCOPE

The scope of this framework is specifically focusing on enterprise engineering a cooperative venture capital model for the commercialisation of intellectual property created by public funded higher education universities in South Africa. However, the practical applications of the framework are not necessary limited to only this scope.

The framework is ideally suitable for clusters consisting out of strong human and/or knowledge capital components. Here the human capital component refers specifically to a group of people possessing skills, knowledge and experience in a specific field that could be potentially commercialised or managing the commercialising process. The knowledge capital component is a subcomponent of human capital, but specifically in this instance, refers to the intellectual property that can be commercialised.

Conceptually, these two components can be illustrated by a simplified Rothwell & Zegveld (1985) third-generation innovation model of technology push and market pull (refer to Figure 6.3 below). In this case, the technology push would be the knowledge capital component while the market pull would be a human capital component.

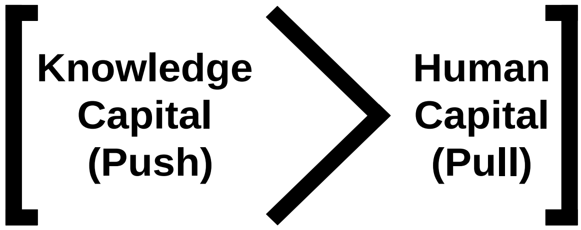


Figure 6.3: Simplified technology push and market pull model adapted from Rothwell & Zegveld (1985) third-generation model

In essence, this CVCF can be applied to organisations with a large pool of intellectual property (knowledge capital) and skilled individuals (human capital) through which start-ups managed by skilled individuals can commercialise the intellectual property. A general example of such an organisation would be Higher Education Institutions such as universities, large corporations with technology transfer offices or looking to establishing spin-off companies, large corporations that are looking to lay off employees, and small innovation and/or start-up ecosystems.

This is however, not the particular focus of this Framework in this research thesis and it is recommended as potential future studies for evaluating the different practical applications of the framework and to possibly do the development of the framework in a real-life case study.

6.2.2. KEY ASSUMPTIONS

The main key assumptions are the following two aspects:

(1) For the purpose of this Framework, the financial viability for each scenario is not within the scope of this study and therefore, it will remain a conceptual matter to be evaluated specifically in the development of the CVCF. The Framework will require financial feasibility in a financial model after the CVCF has been populated.

(2) It is also important to note that this CVCF was developed on the functionality of the emerging economy of South Africa. It can, therefore, not be assumed to be necessarily applicable globally and will require specific analysis of each country's socio-economic factors and innovation ecosystem. The legal structure of each country also varies, making the application more complex.

Other development assumptions are the following:

(1) Social science aspects such as the culture of the organisation are also an essential aspect to the success of the implementation of the CVCF. The spirit of innovation, the culture of entrepreneurship and the community of practice all form part of the essential aspects. However, for the development purposes of this Framework, these elements are regarded as successfully implemented. The social science aspects lie outside the scope of this research but should be considered in further research work on this Framework.

(2) Input analysis is regarded as sufficient to define the problem statement while a brief additional market survey will suffice in evaluating the need for the Framework.

6.3. FRAMEWORK'S DESIGN CRITERIA FROM FIELDS OF CONCERN

The keywords of the research study give an overview of the various fields covered. The fields of concern cover the various disciplines in this research study as well as the design criteria that are comprised of the literature review of the fields of concern.

6.3.1. KEYWORDS OF THIS RESEARCH

This research thesis covers the following aspects in this research study that were identified in the literature review chapters:

> **Innovation Ecosystem**, *Higher Education Institutions*, Intellectual Property, Technology Transfer, Innovation, **Innovation models**, *Integrated Knowledge Network models*, **Venture Capital**, Venture Financing, *Start-up Businesses*, SMEs, **Cooperative models**, Strategic Management, Venture/Start-up Growth, and Entrepreneurship.

These research keywords fall primarily under four main research disciplines, which are ***knowledge management, innovation management, strategic management*** and ***business management***. These disciplines can also be regarded as the specialised discipline of the systems engineering field, which is ***enterprise engineering***, also known as organisation engineering. This is conceptually illustrated in Figure 6.4 below, while the mapping of the relevant field should only be regarded as conceptual and not an exact representation of the various fields in relation to each other.

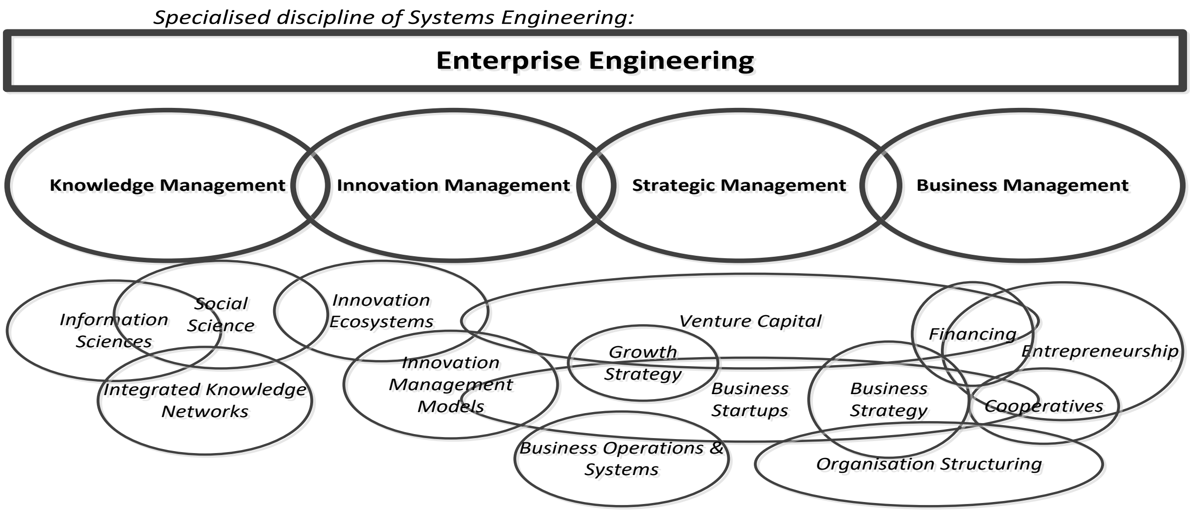


Figure 6.4: Conceptual Mapping of the Related Fields of Concern Regarding this Research Thesis

For the purpose of this research, five main fields of concern were considered and discussed in more detail with their specific influence on the Framework's design criteria. They are the following:

- Innovation Ecosystem & Higher Education Institutions (innovation management),
- Innovation models (innovation management),

- Integrated Knowledge Network models (knowledge management),
- Venture Capital models (business management and entrepreneurship), and
- Start-ups, Strategy and Growth (strategic management, and entrepreneurship).

There are also minimum design criteria established under the field of enterprise engineering that will be discussed in more detail on specifically how the framework complies with those criteria and ultimately makes this research fall under the domain of enterprise engineering.

6.3.2. DESIGN CRITERIA FROM FIELDS OF CONCERN

As mentioned above, the six main fields of concern and their related design criteria for the Framework will be discussed in more detail in this section. Each of these fields of concern was identified and regarded as relevant in the literature review chapters.

6.3.2.1. INNOVATION ECOSYSTEMS AND SOUTH AFRICA

In Chapter 2, a literature review was done on the innovation ecosystems and specifically looked at South Africa's innovation ecosystem with a special focus on publicly funded universities. The different role players in commercialising intellectual property were discussed, specifically those related to higher education institutions.

The key importance of this field of concern is to map out the innovation ecosystem within which start-up businesses operate and whether the capacity is there that will drive the innovation process in the development of the framework. The importance of understanding the dynamics of the South African innovation ecosystem is vital to identifying gaps, challenges and success factors for start-up businesses. The gaps in the innovation ecosystem are the missing components inhibiting the success of start-up businesses, and the Framework will be required to consider these components in the design process.

This field of concern will contribute to the input analysis phase in the systems engineering process as defined in the structure of the framework section. The input analysis consists of three dimensions that include the purpose, capacity and gap analysis. The criteria and detailed process of this analysis are discussed later while, in the synthesis of the literature review of this field of concern, the design criteria are summarised in Table 6.2 below.

Table 6.2: South African Innovation Ecosystem Framework Design Criteria

Ref.	Framework Design Criteria	*Notes*
FDC: 1.0	**FDC: 1.1** A framework focused on the innovation output and improved innovation efficiency.	*South Africa's innovation output and subsequently its innovation efficiency is below par and similar competing countries.*
	FDC: 1.2 A framework supporting the innovation value chain and acting as a key enabler with its specific innovation process.	*In South Africa's relatively immature innovation ecosystem, all structures supporting the innovation value chain is essential and will contribute positively towards innovation output.*
	FDC: 1.3 A framework enabling the reduction in innovation capital gaps to support and further enable the innovation value chain.	*The valley of death is a global phenomenon, but in South Africa certain industries seem to suffer from multiple innovation capital gaps.*
	FDC: 1.4 A framework that enables elements of an entrepreneurial university and a shift towards an entrepreneurial university paradigm.	*As discussed in a start-up and entrepreneurial ecosystem, certain key elements are required to support entrepreneurial universities.*
	FDC: 1.5 A framework that improves the spin-off businesses that are created from intellectual property from public funded universities in South Africa.	*Technology transfer in South Africa is underperforming to international benchmarks and specifically with regards to creating spin-off businesses.*

6.3.2.2. START-UP BUSINESSES, STRATEGY AND GROWTH MODELS

In Chapter 4, a literature review was done on the field of strategic management and entrepreneurship, and relevant aspects regarding entrepreneurs and their start-ups, to identify the best practice for successful start-ups. The dynamics revolving round entrepreneurs and start-ups were investigated to further identify growth components, inhibitors and necessities.

These fields of concern are important to the Framework as they are regarded as the key drivers in the commercialisation process. The CVCF will mainly aim to enable start-up businesses to grow from invention to innovation in the market. This field of concern will contribute partially to the organisational fit (black box) and mainly to the enterprise innovation process (black box) phases in the systems engineering process as defined in the structure of the conceptual framework. The design criteria formulated from Chapter 4 are synthesised in Table 6.3 below.

Table 6.3: Start-up Businesses Framework Design Criteria

Ref.	Framework Design Criteria	Notes
FDC: 2.0	**FDC: 2.1** The enterprise innovation process of the framework should enable a hypothesis-driven entrepreneurial approach.	*This experimental approach to gain continuous validated learning is seen as the best entrepreneurial approach and aligns nicely with the lean methodology and states growth models.*
	FDC: 2.2 The framework should mitigate numerous start-up business growth challenges, both internal and external.	*The challenges facing entrepreneurs and start-up businesses are either seen as internal or external detriments which need to be mitigated or addressed through support.*
	FDC: 2.3 The enterprise innovation process should include entrepreneurial teams, not individuals, and also include management practices of the innovation process.	*The entrepreneurial team has been consistently indicated as more successful than individual entrepreneurial ventures. Entrepreneurship as management is also a lean principle.*
	FDC: 2.4 The enterprise innovation process of the framework should fundamentally include the lean start-up methodology and the strategic fit model.	*These two strategic management models have been chosen as the best practice models for star-up businesses.*
	FDC: 2.5 The enterprise innovation process of the framework should fundamentally include the growth states models.	*The growth states model best describes the complex dynamic process of growth for start-up businesses.*

6.3.2.3. INNOVATION MODELS

In Chapter 3, a literature review on innovation management and specifically innovation models was selected relevant to this research study. The dynamics of innovation models were investigated to establish their roles and functions to organisations and start-up businesses. Different innovation models were evaluated, and best practices were identified. This field of innovation models is regarded as a field of concern in the development of the Framework because of its importance in developing a competitive advantage for the organisation.

All innovation models have their own benefits and drawbacks, and since there is an abundance of variables influencing innovation and the design process, no model can inclusively cover all the different views on application areas. However, the innovation models have established the best practice and have shown successful implementation in practise. The key importance of this field of concern is its relevance to the design process in the discipline of enterprise engineering.

This field of concern will contribute mainly to the enterprise innovation process (black box) and partially to the organisation structure fit (black box) phases in the systems engineering process as defined in the structure of the framework section. In a synthesis of the literature review of this field of concern, the design criteria are summarised in Table 6.4 below.

Table 6.4: Innovation Models Framework Design Criteria

Ref.	Framework Design Criteria	*Notes*

FDC: 3.0	**FDC: 3.1** The enterprise innovation process fundamentally requires both a technological push and market pull.	*Developing technology without a client ultimately buying the technology is a failure. Innovation requires an inventor and a paying customer.*
	FDC: 3.2 The enterprise innovation process requires the general processes to integrate components and functions.	*Modern innovation process integrates its various components and functions unlike linear innovation models to provide a solution for more complex problems.*
	FDC: 3.3 The enterprise innovation process requires a good balance between inventing and commercialisation.	*For example, the Fugle Innovation Model.*
	FDC: 3.4 The enterprise innovation process requires to be designed for start-up businesses and dynamics of entrepreneurship, mitigating related risks.	*Most innovation models are geared towards larger organisations and fundamentally neglect critical issues relating to entrepreneurs and start-up businesses.*
	FDC: 3.5 The enterprise innovation process must enable both incremental and disruptive innovation.	*Strategic management must enable both incremental and disruptive innovation, avoids neglecting or prohibiting the other. For example, Kodak company.*
	FDC: 3.6 The enterprise innovation process requires 'gate-keepers' to enable the innovation process while specifically looking at taking innovation to market.	*The innovation council easily rejects ideas and inventions without ever allowing them to be tested in the market.*
	FDC: 3.7 The enterprise innovation process requires taking into consideration the additional benefits provided by the type of organisation structure.	*Different types of organisational structures have different effects on the innovation process and often neglect to consider them in the development process.*
	FDC: 3.8 Incentive structures and organisational culture need to be considered in the enterprise innovation process as well as the organisational structure fit.	*The importance of the right incentive structures and the culture of the organisation have shown the difference between successful and not so successful organisations.*

6.3.2.4. KNOWLEDGE NETWORK MODELS

In Chapter 5, a literature review on knowledge management and specifically knowledge network models was selected as relevant to this research study. The definition of intellectual capital and the value it has to any organisation are important to understand the process of managing knowledge. Various information and knowledge management models are discussed, and the best practice of integrated knowledge networks was chosen as best suited for the Framework.

This field of concern will contribute mainly to the enterprise innovation process (black box) and partially to the organisation structure fit (black box) phases in the systems engineering process as defined in the structure of the Framework section. In a synthesis of the literature review of this field of concern, the design criteria are summarised in Table 6.5 below.

Table 6.5: Integrated Knowledge Networks Framework Design Criteria

Ref.	Framework Design Criteria	Notes
FDC: 4.0	**FDC: 4.1** The management of the knowledge is essential to forming the basis of innovation and	*Knowledge management is best practices.*

	are required to be taken into consideration in the enterprise innovation process.	
	FDC: 4.2 The necessary financial and intellectual capital structures are required to be incorporated into the framework.	*The total value of a business or organisation includes financial and intellectual capital.*
	FDC: 4.3 The enterprise innovation process requires the necessary information and knowledge flow provided by knowledge network models.	*The integrated knowledge network model is the most comprehensive knowledge network model and is considered for managing the information and knowledge flow for this framework.*

6.3.2.5. VENTURE CAPITAL MODELS

In Chapter 3, a literature review was conducted on the organisational structure and process of venture capital models, which were selected as relevant to this research study. This field of concern will contribute evenly to the enterprise innovation process (black box) and the organisation structure fit (black box) phases in the systems engineering process as defined in the structure of the framework section. This venture capital model also contributes to the foundation of the output illustrated in the enterprise functional synthesis phase. In a synthesis of the literature review of this field of concern, the design criteria are summarised in Table 6.6 below.

Table 6.6: Venture Capital Models Framework Design Criteria

Ref.	Framework Design Criteria	Notes
FDC: 5.0	**FDC: 5.1** The funding process of the venture capital model is required to be considered in the enterprise innovation process of the framework.	*The requirements of venture capitalists in the funding process are important to consider, as well as the selection of portfolio companies. General rules are also important.*
	FDC: 5.2 In the funding process of the venture capital model, an exit strategy is developed which is required for consideration in the enterprise innovation process of the framework.	*There is plenty of value in the venture capital funding and innovation process to mitigate risks and to improve the realisation of wealth. The exit strategy is vitally part of this process.*
	FDC: 5.3 In the organisational structure, the venture capital model's fund management and risk mitigation properties are required in developing the framework.	*The organisational structure manages both financing, wealth creation and risk mitigation, which can be considered as important for the framework.*
	FDC: 5.4 Best practice in venture capital is to be used as a consideration in developing the framework.	*The conceptual rules of venture capital for managing risk and funding are important in for the enterprise innovation process and organisational structure of the framework.*

6.3.2.6. COOPERATIVE MODELS

In Chapter 5, a literature review was conducted on the organisational structure and process of cooperative models, which were selected as relevant to this research study. Cooperatives have been used extensively for enabling entrepreneurship in emerging economies worldwide. As an organisational structure it boosts numerous benefits to enabling entrepreneurship, and modern hybrid cooperative models provide further flexibility and integration with other funding mechanisms. Therefore, this field is selected for its flexibility and integration capability as the foundation of the organisation structure.

This field of concern will contribute mainly to the organisation structure fit (black box) and partially to the enterprise innovation process (black box) phases in the systems engineering process as defined in the structure of the framework section. This cooperative model also contributes to the foundation of the output illustrated in the enterprise functional synthesis phase. These design criteria are synthesised and illustrated in Table 6.7 below.

Table 6.7: Cooperative Models Framework Design Criteria

Ref.	Framework Design Criteria	Notes
FDC: 6.0	**FDC: 6.1** The organisational structure fit of the framework is required to consider the different types of cooperative activities and models.	*In selecting the organisational structure fit of the framework, the different benefits and drawbacks of the different cooperative models and activities are to be considered.*
	FDC: 6.2 The organisational structure fit of the framework is required to consider the level of the hierarchy in the cooperative model chosen.	*A cooperative can be structured with primary, secondary and tertiary cooperatives, which need to be aligned appropriately with the purpose of the framework.*
	FDC: 6.3 The organisational structure and enterprise innovation process are required to mitigate risks through addressing the challenges faced with cooperative structures.	*There are numerous challenges that are associated to cooperatives and mainly cause an increase in complexity and managing risks. These challenges can be addressed and mitigated through considering best practice from other fields.*
	FDC: 6.4 The legal policy per country regarding cooperatives as a business entity needs to be considered in the structuring and financing of the cooperative.	*Each country has a different legal structure which business entities are required to comply with. These aspects are essential to be taken into consideration in structuring and financing the cooperative.*
	FDC: 6.5 The role of entrepreneurship and enabling business development in cooperatives are to be considered in the development and structuring of the organisational structure of the framework.	*Entrepreneurship and business development are to be enabled and not restricted by 'gate-keepers'. Flexibility in developing a business is essential and especially in considering the diversity of business growth.*

6.4. FRAMEWORK DEVELOPMENT PROCESS AND FUNCTIONS

This section will define the process, functions and thinking behind the development of the Cooperative Venture Capital Framework (CVCF). The process that will be used in developing the CVCF is the black box systems engineering process.

The black box system is used in various domains such as philosophy, science and engineering. From a systematic viewpoint, the black box process or system is divided into three main phases, namely input, output and transfer (black box). The knowledge of the internal workings for the transfer phase remains the mystery of the black box system as illustrated in Figure 6.5 below.

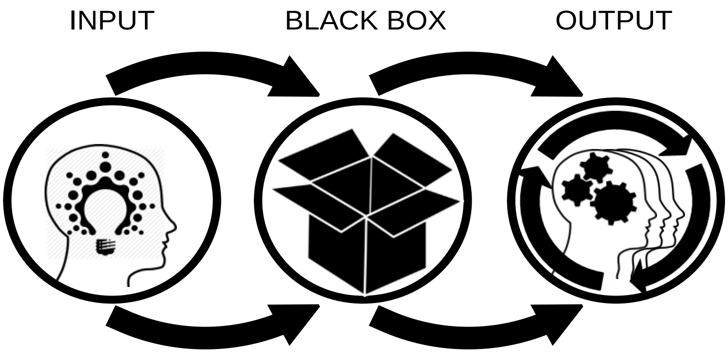


Figure 6.5: A Generic Black Box System Process

The exact origin of the black box theory is undisclosed and debated in literature, but for the purpose of this research thesis, the black box system will only be used to visually illustrate the system engineering approach that will be followed in developing the framework. In essence, this simplistic illustration forms the foundation of the phases for structuring the framework. In other words, input variables will be decided upon by the organisation, which it regards as essential to plug into the CVCF which is represented by the black box. This will produce the output of a specific Cooperative Venture Capital Model (CVCM) for the purpose as defined by the organisation wishing to implement it.

Therefore, the structuring of the framework using the black box system will be subdivided into four main phases that are as follows:

- **(1)** Capacity and Gap Analysis phase (INPUT),
- **(2)** Organisation Structure Fit phase (BLACK BOX),
- **(3)** Enterprise Innovation Process phase (BLACK BOX), and
- **(4)** Enterprise Functional Synthesis phase (OUTPUT).

These phases will govern the overview system engineering approach followed in designing the framework while enterprise engineering principles together with the design criteria will regulate the functional purposes developed of the overall CVCF. This structuring of the black box systems process is conceptually illustrated below in Figure 6.6, with an indication of how the input affects which phases of the black box produce the output.

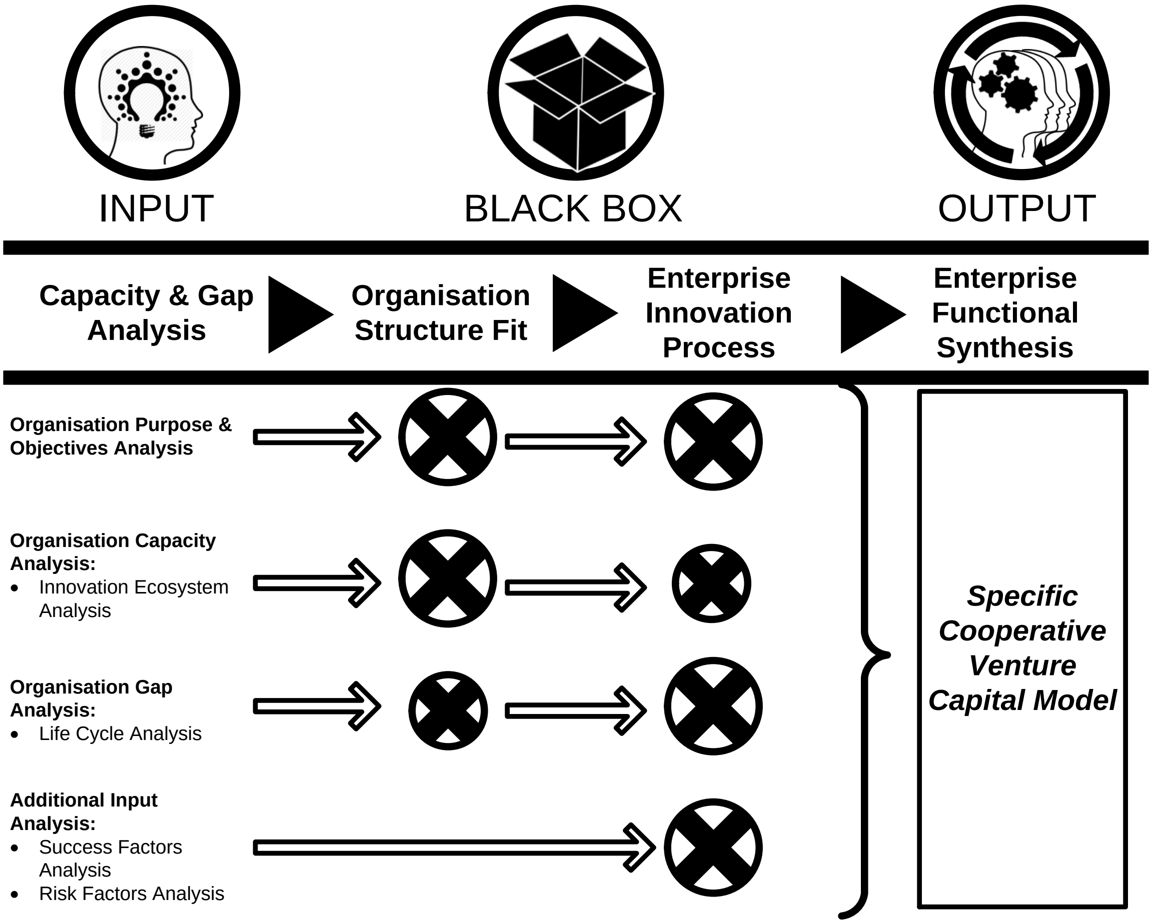


Figure 6.6: Summary of the Black Box Systems Process in Developing the Framework

6.4.1. CAPACITY AND GAP ANALYSIS (INPUT)

The sub-framework objective of the input analysis, as described in Table 6.1 above, is as follows:

> **[SFO: 1.0]** ***Develop a framework addressing problems in a given innovation ecosystem with an emphasis on innovation output.***

It is important to understand that the input analysis is not an exact science and relies heavily on qualitative surveys and personal understanding and experience of the person completing the input analysis. This said it remains a vitally important aspect for the CVCF implementation to be effective and applicable to the environment it is applied in. In the book '*Start with why*' by Sinek (2009), defines the *golden circle* concerning the *why, how* and *what* organisations do. The core concept of the golden circle is summarised in Figure 6.7 below and is integrated with the input analysis of the black box systems engineering process of the CVCF.

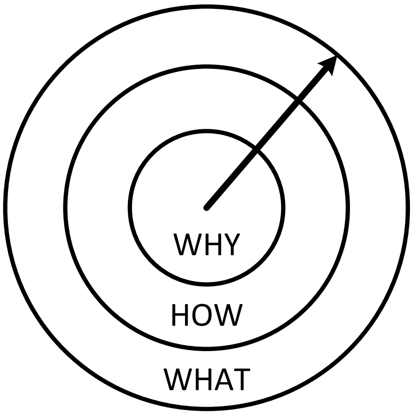


Figure 6.7: The Golden Circle adapted from Sinek (2009)

The input analysis can mainly be divided into internal and external components that are required to be analysed whereby the internal refers to the purpose and the external refers to the gap analysis, while the capacity analysis considers both internal and external components. This input analysis is integrated with the golden circle of Sinek (2009) as follows:

- **WHY:** The purpose analysis establishes a vision with a greater purpose, cause or belief in constructing the CVCM. This, for example, is the purpose of regional development and supporting or further developing an innovation ecosystem.
- **HOW:** The capacity analysis is the knowledge and human capital required for the implementation of the CVCM. This is also conceptually illustrated in Figure 6.3 above.
- **WHAT:** The gap analysis establishes the challenges and risks that the CVCM needs to overcome and/or mitigate in order to structure the CVCM effectively to have the highest chance of being successfully implemented.

The design criteria from the literature review as defined above that the input analysis is subjective to, are as follows:

> **[FDC: 1.1]** ***A framework focused on the innovation output and improved innovation efficiency.***
>
> **[FDC: 1.3]** ***A framework enabling the reduction in innovation capital gaps to support and further enable the innovation value chain.***
>
> **[FDC: 2.2]** ***The framework should mitigate numerous start-up business growth challenges, both internal and external.***
>
> **[FDC: 6.4]*** ***The legal policy per country regarding cooperatives as a business entity needs to be considered in the structuring and financing of the cooperative.*** [**This will only include initial input and will be discussed in more detail in the organisational structure*].

It should also be noted that there are numerous other additional input analyses that can be completed, but for the purpose of this research study, only the selected analyses will be discussed. The key importance in the input analysis is to evaluate whether there is enough knowledge and human capacity in the desired organisation and/or area to implement the CVCF. Therefore, evaluate that existing organisation and/or area to understand the various gaps in order to support entrepreneurial teams and start-up businesses commercialising intellectual property. Refer to Figure 6.3 above to conceptually understand the scope of the framework and to what extent the input analysis is applicable.

6.4.2. ORGANISATION STRUCTURE FIT (BLACK BOX)

The sub-framework objectives of the organisation structure fit, as described in Table 6.1 above, are as follows:

> **[SFO: 2.0]** ***Develop a flexible organisational structure supporting entrepreneurial teams.***
>
> **[SFO: 5.0]** ***Mitigate risk factors and implement success factors.***

The organisation structure is a very important aspect to consider when developing a CVCF. In this framework, the aim is to combine both the organisational structure of a venture capital model (Chapter 3) and a cooperative model (Chapter 5). Through integrating these models into the cooperative venture capital organisation structure, a specific focus on innovation and entrepreneurial start-up businesses is made.

The design criteria from the literature review as defined above that the organisation structure fit is subjective to, are as follows:

> **[FDC: 3.8]** ***Incentive structures and organisational culture needs to be considered in the enterprise innovation process as well as the organisational structure fit.***
>
> **[FDC: 4.2]** ***The necessary financial and intellectual capital structures are required to be incorporated into the framework.***
>
> **[FDC: 5.3]** ***In the organisational structure, the venture capital model's fund management and risk mitigation properties are required in the developing the framework.***
>
> **[FDC: 5.4]** ***Best practices in venture capital are to be used as considerations in developing the framework***.
>
> **[FDC: 6.1]** ***The organisational structure fit of the framework is required to consider the different types of cooperative activities and models.***
>
> **[FDC: 6.2]** ***The organisational structure fit of the framework is required considered the level of the hierarchy in the cooperative model chosen.***
>
> **[FDC: 6.3]** ***The organisational structure and enterprise innovation process are required to mitigate risks through addressing the challenges faced with cooperative structures.***
>
> **[FDC: 6.4]** ***The legal policy per country regarding cooperatives as a business entity needs to be considered in the structuring and financing of the cooperative.***
>
> **[FDC: 6.5]** ***The role of entrepreneurship and enabling business development in cooperatives are to be considered in the development and structuring of the organisational structure of the framework.***

Notably, each country has their specific legalisation framework, which, of course, will govern key aspects such as the legal entities within that specific country whereby benefits, drawbacks, flexibility and potential revenue structures will obviously differ. The specific legislation for the country the CVCM is being developed for will be required to be evaluated in order to clarify any legal issues surrounding the cooperatives and doing business within that country.

6.4.3. ENTERPRISE INNOVATION PROCESS (BLACK BOX)

The sub-framework objectives of the enterprise innovation process, as described in Table 6.1 above, are as follows:

> **[SFO: 3.0]** ***Develop a complete innovation process supporting the important phases of the entrepreneurial development.***
>
> **[SFO: 4.0]** ***Supporting entrepreneurial teams throughout the innovation value chain.***
>
> **[SFO: 5.0]** ***Mitigate risk factors and implement success factors.***

The design criteria from the literature review as defined above that the enterprise innovation process is subjective to, are as follows:

> **[FDC: 1.2]** ***A framework supporting the innovation value chain and acting as a key enabler with its specific innovation process.***
>
> **[FDC: 2.1]** ***The enterprise innovation process of the framework should enable a hypothesis-driven entrepreneurial approach.***
>
> **[FDC: 2.3]** ***The enterprise innovation process should include entrepreneurial teams, not individuals and include management practices of the innovation process.***
>
> **[FDC: 2.4]** ***The enterprise innovation process of the framework should fundamentally include the lean start-up methodology and the strategic fit model.***
>
> **[FDC: 2.5]** ***The enterprise innovation process of the framework should fundamentally include the growth states models.***
>
> **[FDC: 3.1]** ***The enterprise innovation process fundamentally requires both a technological push and market pull.***
>
> **[FDC: 3.2]** ***The enterprise innovation process requires the general processes to integrate components and functions.***
>
> **[FDC: 3.3]** ***The enterprise innovation process requires a good balance between inventing and commercialisation.***
>
> **[FDC: 3.4]** ***The enterprise innovation process requires to be designed for start-up businesses and dynamics of entrepreneurship, mitigating related risks.***
>
> **[FDC: 3.5]** ***The enterprise innovation process must enable both incremental and disruptive innovation.***
>
> **[FDC: 3.6]** ***The enterprise innovation process requires 'gate-keepers' to enable the innovation process while specifically looking at taking innovation to market.***
>
> **[FDC: 3.7]** ***The enterprise innovation process requires taking into consideration the additional benefits provided by the type of organisation structure.***
>
> **[FDC: 4.1]** ***The management of the knowledge are essential to forming the basis of innovation and are required to be taken into consideration in the enterprise innovation process.***
>
> **[FDC: 4.2]** ***The necessary financial and intellectual capital structures are required to be incorporated into the framework.***

[FDC: 4.3] ***The enterprise innovation process requires the necessary information and knowledge flow provided by knowledge network models.***

[FDC: 5.1] ***The funding process of the venture capital model is required to be considered in the enterprise innovation process of the framework.***

[FDC: 5.2] ***In the funding process of the venture capital model, an exit strategy is developed which is required for consideration in the enterprise innovation process of the framework.***

[FDC: 5.4] ***Best practices in venture capital are to be used as considerations in developing the framework.***

The enterprise innovation process is specifically designed taking into account the following four aspects to form the foundation of the innovation process. The foundation of the enterprise innovation process is then compiled and integrated to form a complete process to support entrepreneurial teams. The foundation of the enterprise innovation process includes the following:

- Start-up businesses growth and standardised financial roadmap;
- Start-up business growth challenges and gaps (valley of death);
- Business incubators support programmes;
- CVCM management and executive's role and high-level functions.

It also considers integrated processes and systems supporting the enterprise innovation process that includes the following support components:

- The information technology (IT) back-end platform supporting the information and knowledge management of the enterprise innovation process and organisation structure;
- Integrated knowledge networks and the role of the information and knowledge management;
- The role of catalyst collaborative projects supporting the enterprise innovation process.

6.4.4. ENTERPRISE FUNCTIONAL SYNTHESIS (OUTPUT)

The sub-framework objectives of the enterprise functional synthesis, as described in Table 6.1 above, are as follows:

[SFO: 6.0] ***The framework should develop a specific cooperative venture capital model for the defined purpose.***

The design criteria from the literature review as defined above that the enterprise functional synthesis is subjective to, are as follows:

[FDC: 1.4] ***A framework that enable elements of an entrepreneurial university and a shift towards an entrepreneurial university paradigm.***

[FDC: 1.5] ***A framework that improves the spin-off businesses that are created from intellectual property from public funded universities [in South Africa].***

The aim of the CVCF is to develop a specific CVCM, based on the input analysis and decisions made through the black box system. However, the next step is to define a measurement analysis of the CVCM. This can be seen as measuring the output, and there are two main aspects regarding this, namely, structural requirements checklist and key performance indicators.

The standardised output will be discussed in Chapter 7 while the enterprise engineering structural components checklist is described below in Table 9. The key would be to measure the output on whether the CVCM is applicable and implementable. The first measurable would be the enterprise engineering structural components checklist which will measure whether the enterprise engineering principles have been applied. The second measurable is the setting of key performance indicators (KPIs) for the various departments of the CVCM.

6.5. STRUCTURE OF THE FRAMEWORK

The six fields of concern each play a vital role in the structuring of the framework and use two main approaches in completing the framework structure. As described above, the black box system engineering approach is used as the framework development process while the enterprise engineering principles will regulate the functional purposes developed of the overall CVCF. In this section, an enterprise engineering methodology is created and consists of enterprise engineering principles, the classification scheme and structural components that will regulate the functional aspects of the CVCF together with the design requirements.

6.5.1. ENTERPRISE ENGINEERING PRINCIPLES

Enterprise engineering dates back to more than a century ago when Taylor (1911) introduced the concept of scientific management that is governed by enterprise development in general. The term enterprise engineering has also been referred to as organisational engineering or organisational design and engineering, with slight differences in understanding and definition. The terms enterprise[104] and organisation[105] are used interchangeably, but differ fundamentally on emphasis as 'organisations' emphasises the structure more than energy. By definition, 'enterprise' is a project undertaken that has an essence of importance and difficulty/risk which requires energy and boldness, whereas 'organisation' refers to a group of individuals organised for a common goal, specific work, association or non-profit organisation.

In this research study, enterprise engineering is used for its particular emphasis on associated risk and venturing importance. This is because, throughout the past century, there has been rapid change in the business, market and technology environments, and subsequent understanding and change to enterprise development approaches (Dietz *et al.,* 2013, p. 91). The term enterprise engineering is the newly adopted concept addressing

[104] Latin word for enterprise comes from *inceptum* and *interprēnsus,* defined as: *beginning, attempt, enterprise.*
[105] Latin word for organisation comes from *organizātiōn* defined with regards to business, as a structure through which individuals systematically conduct business.

the current problems and enterprise changes, in all types and sizes of enterprises. Pilkington (2008)[106] argues that enterprise engineering in essence combines systems engineering and strategic management to optimise an engineering solution in terms of the enterprise products/services, processes and systems. The process, he further argues, needs to continuously innovate through improving and adapting throughout its development life cycles[107].

According to Sage (1992) and Stevens *et al.* (1998), enterprise engineering's approach resembles that of systems engineering, while Hoogervorst (2009), Proper *et al.* (2009) and Dietz (2011) argue it is an emerging sub-discipline of systems engineering. The literature also predominantly bases the root of enterprise engineering (Hoogervorst, 2009, p. 8) specifically on the alignment of the enterprise processes and systems with information system science and organisational sciences (Proper, et al., 2009; Dietz, 2011).

However, Dietz *et al.* (2013, p. 92) argue that there is an important difference as "*enterprise engineering aims to do for enterprises (which are basically conceived as social systems) what systems engineering aims to do for technical systems*". According to Liles *et al.* (1995), enterprise engineering was defined by the Society for Enterprise Engineering as "*the body of knowledge, principles and practices applicable in the analysis, design, implementation and operation of an enterprise*". The core aspects of enterprise engineering include the combination of business processes, information flows and organisation structure (Dietz, 2006).

It is evident that there is still plenty of versatility in the definition and understanding of what exactly the term and concept 'enterprise engineering' is. However, the following subsections will define the requirements for an enterprise engineering frameworks models and theories, specifically relevant to this research study.

6.5.2. ENTERPRISE ENGINEERING CLASSIFICATION SCHEME

Using the classification scheme for enterprise engineering as developed by Dietz, Hoogervorst *et al.* (2013), a deeper understanding of this emerging discipline can be made (refer to Figure 6.8 below). However, each of these theory cases still requires further research and development as the understanding of the application in industry is still lacking. It is, therefore, only to be used as a rough guideline.

The essence in developing any enterprise engineering framework is to ensure that the theoretical foundation as a philosophical definition of enterprise engineering is aligned with the specific framework being developed. The three main generic goals, namely ***intellectual manageability***, ***social devotion*** and ***organisational concinnity***, are the next essential alignment in the framework development process.

[106] *Pilkington, A., 2008. Enterprise Engineering at Royal Holloway, University of London. [Online] Available at http://personal.rhul.ac.uk/uhtm/001/homepage.html [Accessed 29 July 2014].*

[107] *It is also argued that enterprise engineering is to be applied continuously throughout its entire life cycle to achieve its objects and market competitiveness, as argued by Vernadat, F. B., 1996. Enterprise Modeling and Integration: Principles and Applications. Chapman & Hall, London. p. 30.*

Theory Cases	Goals	Theories	Fundamentals
Technological: Technological theories are valued by analysis and synthesis that addresses the means-end relations between phenomena by designing and making things.	**Organisational concinnity:** is conditional for making strategic initiatives operational in order to perform optimally and to implement changes successfully, enterprises must operate as a unified and integrated whole, taking into account all aspects that are deemed relevant.	**β-theory (BETA):** the theory about the development, design, engineering and implementation of systems. **ν-theory (NU):** the theory about the construction of the systems.	**F5:** Distributed operational responsibility. **F6:** Distributed governance responsibility. **F7:** Human-centred and knowledgeable management.
Ideological: Ideological theories are about devising and choosing things to make, addresses the goals people may want to achieve in society at large, and through enterprise development.	**Social devotion:** is the basis for achieving employee empowerment as well as knowledgeable management and governance as modern employees are highly educated knowledge workers and the mindset of managers has not evolved accordingly.	**σ-theory (SIGMA):** the theory about the way modern enterprises should be continued, in particular how they should be governed and managed.	**F3:** Rigorous distinction between design and implementation. **F4:** Diligent application of design principles.
Ontological: Ontological theories are about the nature of things addressing explanatory and/or predictive relationships in observed phenomena.	**Intellectual manageability:** is the basis for mastering complexity of the construction and operation of enterprises, and in order to stay updated through insight and overview concerns of the enterprises and of enterprise changes.	**ψ-theory (PSI):** the theory about the ontological essence of the organisation. **π-theory (PI):** the theory about the ontological essence of the systems of which the elements are non-humans.	**F1:** Strict distinction between function and construction. **F2:** Focus on essential transactions and actors.
Philosophical: Philosophical theories are the foundation that address the very basic conceptual matters including philosophical fields such as epistemology, phenomenology, logic and mathematics.	*theoretical foundation*	**ϕ-theory (FI):** the theory about the nature of factual knowledge. **δ-theory (DELTA):** the theory about the statics, kinematics and dynamics of discrete event systems. **τ-theory (TAO):** the theory about system perspectives.	*theoretical foundation*

NOTE: Arrows indicate foundation to which each theory case is routed in and built on.

Figure 6.8: The Enterprise Engineering Classification Schemed adapted from Dietz *et al.* (2013)

Understanding the complex nature of enterprises and enterprise development complicates the application of each technical enterprise engineering theory and fundamental in each particular enterprise. Thus, a perfectly aligned framework will be hard to come by, especially as these individual theories are still evolving together with the complexity of our understanding of enterprises. The key measurements and classification of the enterprise engineering aspects applied in the development of the framework will therefore be focused on the overall understanding of enterprise engineering and not specifically on each technical enterprise engineering theory and/or fundamental.

6.5.3. ENTERPRISE ENGINEERING STRUCTURAL COMPONENTS

In the literature on enterprise engineering and the classification scheme by Dietz *et al*. (2013), it is fundamentally evident, based on the theories of FI, DELTA and TAO (refer to Figure 6.8), that enterprise engineering is a sub-discipline of systems engineering. Additionally, the classification scheme can be evaluated to develop enterprise engineering structural components whereby six components can be derived as follows:

(1) ***Enterprise operational processes and systems;***

(2) ***Human resource management and incentives;***

(3) ***Information and knowledge flow;***

(4) ***Organisational structure;***

(5) ***Strategic management of initiatives***;

(6) *Overall integration of complex systems and structures.*

The **(1)** enterprise operations include all the processes and systems put in place that creates a specific value proposition that is sold to its customers. It is based on the ontological theory of PI where the essence of the elements of the system is non-human. This, for example, includes elements of the administration-, documentation-, information-, manufacturing processes, etc. that are automated, but essential to the business. Then, based on the technological theories, BETA and NU are processes and systems that are aimed to design, construct and implement the processes and systems of the business. This could include departments such as research and development, manufacturing, procurement, logistics, supply chain, marketing and sales.

Another important theory is the ideological theory of SIGMA aiming to improve the outcome of the business which identifies the human role in the enterprise processes and systems. Tools and methods exist aimed at enhancing the enterprise performance and/or managing change, for example, activity-based costing, business process management, customer relationship management, lean production, lean start-ups, learning organisations, six sigma design and quality management.

The **(2)** human resource management and incentives structure component is the process of hiring and developing employees as a function in the organisation, designed to maximise and incentivise employee performance in service of their employer's strategic objectives. It is based on the technological theory’s fundamentals of distributing operational (F5) and governance responsibility (F6). It also aligns to the enterprise engineering generic goal of social devotion with the emphasis on a learning organisation whereby human resources are transforming information into knowledge and experience. This specifically also relates to the ideological theory whereby the governance and management are focused on the diligent application of design and implementation principles.

The SIGMA theory specifically relates to the best practices identified in governing and managing the human resources for enterprise development. An example can include continuous professional development for employees incentivised by promotions to further their knowledge, which in return can be applied to develop the enterprise. This governance and management are not only the hierarchy structure of the organisation, but strongly associated to the culture of the organisation. Another fundamental (F7) illustrates the relationship between human-centred and knowledge management, whereby the enterprise is improved through continuous learning and relates to the structural component of information and knowledge flow.

The **(3)** information and knowledge flow as a structural component is philosophically the case in the theory of FI as the nature of factual knowledge and is further iterated as a fundamental (F7) as a key relationship between human-centred and knowledge management. It is also essential for aligning the generic goal of enterprise engineering — social devotion. This information and knowledge flow forms part of the field of information system sciences and includes a strong degree of social science into the development and application of the enterprise integrated information and knowledge management system. While Dietz *et al*. (2013) argue the importance of Information Communication Technology (ICT) services as a business back-end it has also become increasingly vital to the success of improving performances of enterprises. However, ICT remains a supporting component, but it must remain human-centred and emphasising knowledge management, not solely information management.

Information and knowledge management are a multi-disciplinary approach for enterprises to achieve their objectives and involve the process of collection, development, distribution and effective usage of the enterprise knowledge (Gupta & Sharma, 2004). This is where the enterprise's intellectual property is not necessarily shared in the public domain through such means as patents, but the enterprise *'know-how'* and *'trade secrets'* are created and distributed among employees. This should not be confused with the field of library science and/or computer science, but a strong ICT backbone enables effective utilisation of information and knowledge management. The key tools and methods used by information and knowledge management are typically aligned with the enterprise objectives by lessons learned on sharing, performance improvement, innovation, competitive advantage, integration and continuous improvement of the enterprise (Tiwana, 2000).

The **(4)** organisational structure falls under the field organisational sciences and has a strong social science component. Organisational structure also includes a component of business structuring in relation to the business operational processes, as well as taking into consideration legal entities and policies. The organisational structure is based on the ontological theory case with an emphasis on the organisational structure illustrated in the theories of PSI and PI. The enterprise engineering generic goal of intellectual manageability emphasises the relationships between entities within the enterprise forming the essence of the organisation. Clegg & Bailey (2008) define organisational sciences as how organisational structures, processes and practices are constructed and examined, as well as the impact the organisation structure has on social relations and influence on its employees. Key tools and methods such as corporate governance, corporate social investment, employee incentive bonuses, employee performance indicators, organisational culture and organisation type all play a role.

The **(5)** managing of strategic initiatives falls under the field of strategic management and is associated with the design and implementation of systems. This is mainly derived from the ideological and technological theory cases (SIGMA, NU and BETA theories) and requires continuous decision-making to design and implement modern 'initiatives' aiming to improve the enterprise. As a fundamental (F4) there is further emphasis on the diligent application of the design principles iterating the need for strategic planning and decision-making during the implementation of 'initiatives'. This is also essential in achieving the generic goal of enterprise engineering — organisational concinnity. So what is the role of strategic management for designing and implementing concepts and technologies in enterprises?

According to Nag *et al.* (2007, p. 94-95), the definition and consensus of the strategic management discipline has evolved over time with various definitions arguing both for and against it. It is also noted that strategic initiatives form a vital part of strategic management and Teece (1990) argues the importance of the implementation of all strategic initiatives as fundamental. Bryan & Joyce (2007, p. 25) describe that the organisational design should be associated with the corporate strategy development and implementation. However, according to Mintzberg (1994) and, Kaplan & Norton (2004) extensive research studies show that strategic initiatives have a success rate of between 10% and 30% which means that strategic objectives are not achieved. The failure of strategic initiatives is shown in research to be caused by inadequate implementation rather than poor strategic formulation (Dietz, et al., 2013). The purpose of strategic management for this framework will be governed by the design criteria of achievability and implementable strategic initiatives formulated in the framework.

The **(6)** overall integration of a complex system and the various processes, components and members of the various structures is the final enterprise engineering structural component. This structural component in essence focuses on the embodiment and integration of the complex system as a whole. The key question is whether the various components structurally fit in combination? This is the underlining basis of the ontological theory case and generic goal of intellectual manageability in enterprise engineering and is regarded as a suitable structure component. It should be regarded as a high-level structural component embodying the relationship and practicality of all the structural components as a whole. This will also include the allocation of key performance indicators (KPIs) and measuring the KPIs to compare to industry benchmarks.

6.5.4. ENTERPRISE ENGINEERING SYNTHESIS

Using the literature on enterprise engineering and the classification scheme by Dietz *et al*. (2013), the six enterprise engineering structural components were developed and synthesised in Table 6.9. The essence of the enterprise engineering structural components is to verify whether the framework consists of the necessary components to be considered to the associated field of enterprise engineering.

These structural components aim to support the classification process of the enterprise engineering field and more specifically the foundation to develop best practice for a specific industry the organisation operates in. They also aim to move towards a more practical application of a complete enterprise engineering methodology. The application of this enterprise engineering methodology is essentially governed by the extent to which the different components were considered in the formulation and design process using this methodology. In other words, in this research study they will be used to verify the framework as covering the various structural components.

Table 6.9: Enterprise Engineering Structural Components Synthesis

Ref.	Structural Component	Description	Classification Relation			
			Theory Case	Goal	Theories	Fundamentals
EESC: 1.0	**Enterprise Processes and Systems**	*Enterprise operations include all the processes and systems put in place that create a specific value proposition that is sold to its customers.*	Ontological	Intellectual Manageability	PI	F1, F2
			Technological	Organisational Concinnity	BETA, NU	F5
			Ideological	-	SIGMA	F4
EESC: 2.0	**Human Resource Management and Incentives**	*It is the process of hiring and developing employees as a function in the organisations designed to maximise and incentivising employee performance in service of their employer's strategic objectives.*	Technological	-	-	F5, F6, F7
			Ideological	Social Devotion	SIGMA	-
EESC: 3.0	**Information and Knowledge Management Processes**	*Information and knowledge management is a multidisciplinary approach for enterprises to achieve their objectives and involves the process of collection, development, distribution and effective usage of the enterprise knowledge.*	Philosophical	-	FI	-
			Technological	-	-	F7
			Ideological	Social Devotion	-	-
EESC: 4.0	**Organisational Structure**	*The construction of legal business entities and policies that govern the organisation's processes and practices, as well as the impact the organisation structure has on social relations and influence on its employees.*	Ontological	Intellectual Manageability	PHI, PI	-
EESC: 5.0	**Strategic Initiatives Management**	*The formulation and implementation of the organisation's major goals and initiatives by analysing the internal and external environment to provide the basis for maintaining optimum management practices and entering new markets.*	Technological	Organisational Concinnity	BETA, NU	-
			Ideological	-	SIGMA	F4
EESC: 6.0	**Overall Integration of Complex Systems and Structures**	*Overall integration of a complex system as a whole, as well as how the various processes, components and members of the various structures interact with each other. It also includes an allocation of key performance indicators (KPIs) and measuring the KPIs to compare to industry benchmarks.*	Philosophical	-	DELTA, TAO	-
			Ontological	Intellectual Manageability	PSI	F1, F2

6.6. CHAPTER SYNTHESIS

The synthesis of this chapter is illustrated in Figure 6.9 below whereby the framework development methodology is summarised. The framework requirements analysis (refer to Figure 6.2) is related to the black box systems engineering process of the framework. This summarises the objectives of the framework and the respective design criteria are associated with each component of the framework, while the framework processes and functions are essentially related to the component levers of the framework (black stars). Then lastly, the enterprise engineering structural components requirements verify the output produced by the framework to ensure the application enterprise engineering methodology.

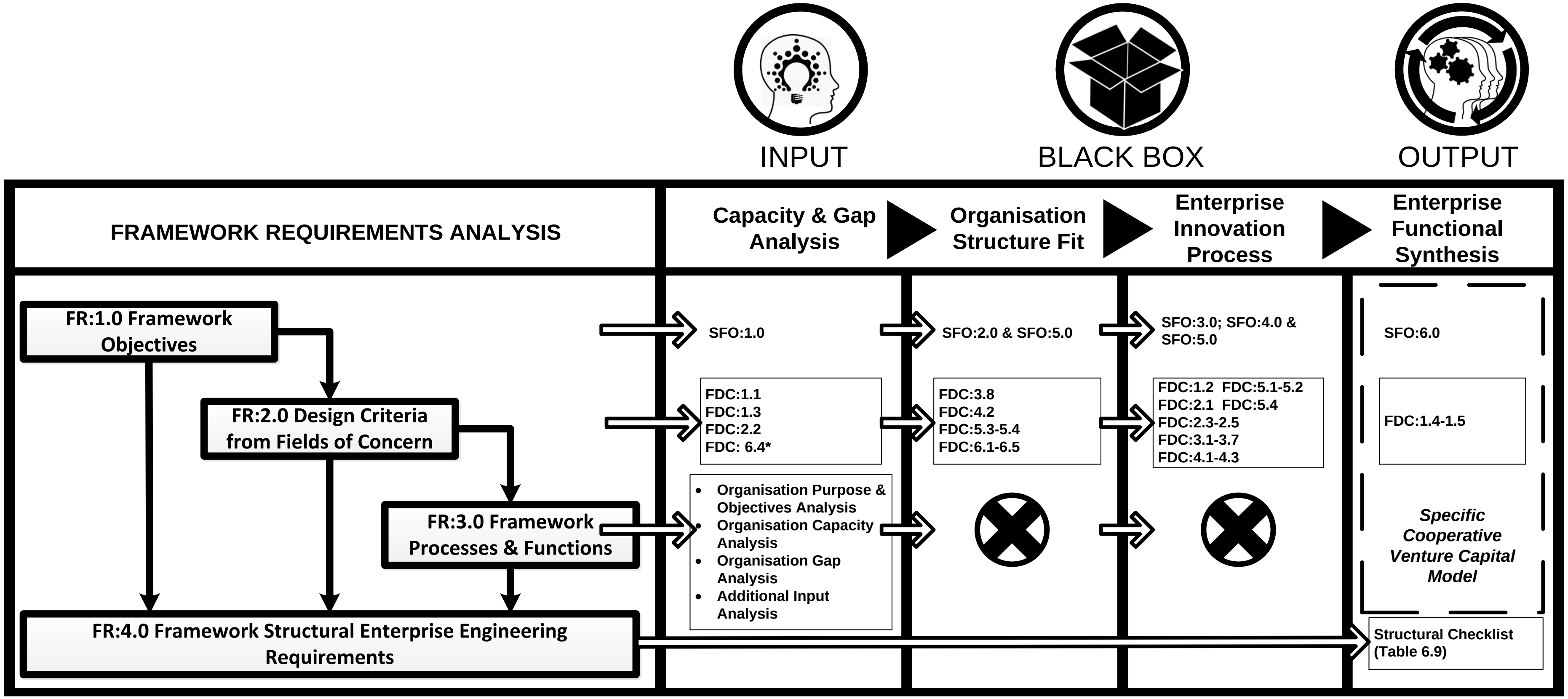


Figure 6.9: The Summary of the Framework Development Methodology

7 The Cooperative Venture Capital Framework

This chapter discusses all the components of the conceptual framework according to the design criteria of the framework development methodology. The framework is also applied in the case study of the University of Stellenbosch ecosystem.

7.1. INTRODUCTION

The purpose of this chapter is to illustrate the developed conceptual framework as developed accordingly to the specifications identified in Chapter 6. The black box systems engineering process is illustrated in Figure 7.1 below and will be discussed as in the following phases:

(1) Capacity and Gap Analysis phase (INPUT),
(2) Organisation Structure Fit phase (BLACK BOX),
(3) Enterprise Innovation Process phase (BLACK BOX), and
(4) Enterprise Functional Synthesis phase (OUTPUT).

These phases combine to form the Cooperative Venture Capital Framework (CVCF) which is summarised in the chapter and illustrated using a case study method to apply the CVCF on Stellenbosch University. Using a case study as an example, the framework objectives and design criteria applied and achieved are illustrated.

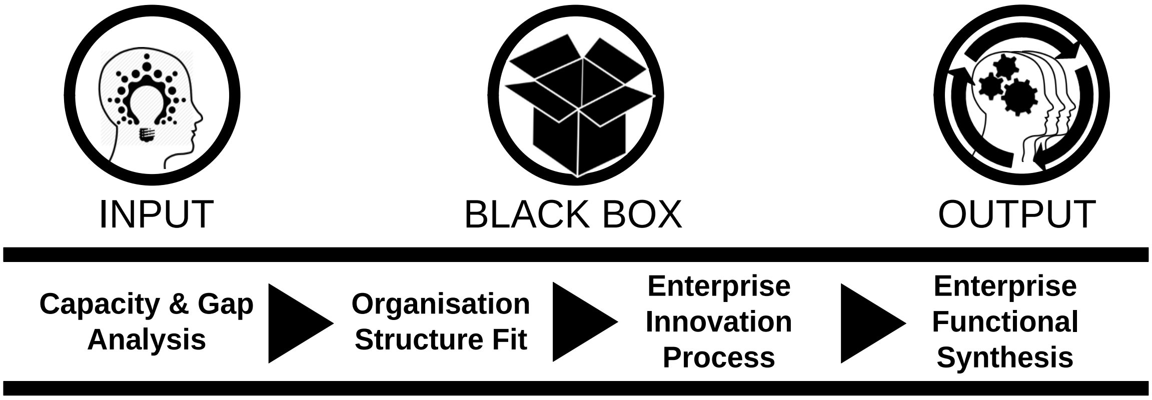


Figure 7.1: Black Box System Engineering Approach of the Cooperative Venture Capital Framework

7.1. CAPACITY & GAP ANALYSIS (INPUT)

In this input analysis, the emphasis is on evaluating whether the organisation or region has the capacity to implement the CVCF and what specific gaps the organisation and/or region has in the innovation value chain. The input analysis integrates the golden circle by Sinek (2009) through defining the specific purpose (why), capacity (how) and gaps (what) the CVCM aims to achieve and is discussed below in more detail.

7.1.1. ORGANISATION FRAMEWORK PURPOSE ANALYSIS (WHY)

The purpose analysis specifically refers to the purpose for developing a CVCM and can be regarded as a high-level design of the CVCM. This can be seen as setting the vision, strategy and tactics (mission), and values of the CVCM. Each organisation or area wanting to use the CVCF will have certain specific attributes and setting within which the CVCM will aim to improve. Generally, this will relate to innovation and entrepreneurship as the core of the CVCF.

This purpose analysis consists of three statements and their associated key questions within in the context of the CVCF as follows:

- **Vision Statement:** *What is the vision of the CVCM?*
- **Mission Statement:** *What is the mission of the CVCM?*
- **Values/Ethics Statement:** *What are the values of the CVCM?*

The vision statement is aimed to provide the overall purpose, direction and inspiration of the CVCM. The vision statement in essence contains the aspiration, inspiration and motivation for implementing the CVCM. Techniques such as a vision board can be assembled and used to develop a vision statement. The mission statement is aimed at the high-level goals set to achieve the vision statement and consists of strategic and tactical components. The values/ethics statement is aimed at the high-level values and ethics of the CVCM which it is subjected to. These statements of the purpose analysis are summarised in Table 7.1 below.

Table 7.1: Summary of the Purpose Analysis

Statements		Description	Determines
Vision		It is the timeless, internally generated aspiration, inspiration and motivation of what the CVCM aims to achieve.	Major markets, uniqueness, skills, competitive advantage, etc. It also forms the basis for possible strategies.
Mission	Strategy	Be a specific time (>1, 5, 10 years etc.), market segment and competitive environment. It aims to answer the high-level concept of how to achieve the vision within the current market, regulatory and competitive environment.	Specific market segments it is pursuing, organisational structures and priorities, regulatory environment, etc. of the CVCM as an organisation. This involves the basis for possible tactics to be developed from.
	Tactics	Is a specific time (<1 year, months etc.) in order to achieve strategic positions and targets with given resources, market, business structures, etc.	This is the daily activities and actions that are required to be implemented to achieve the strategic positions of the CVCM as an organisation. They form the basis for the key performance indicators.
Values		Be the values and ethical issues that the CVCM as an organisation are subjective towards and is aligned with the vision statement.	Ethical and moral decision-making within the CVCM as an organisation.

7.1.2. ORGANISATION CAPACITY ANALYSIS (HOW)

The organisation capacity analysis can be seen as how the CVCF can be implemented. This relates to the mission statement concerning the strategy and tactics as discussed above, but more importantly looks at the knowledge and human capacity to drive the CVCM as an organisation.

7.1.2.1. INNOVATION ECOSYSTEM ANALYSIS

In Chapter 2, the dynamics of the innovation ecosystem were discussed and using the Global Innovation Index report, an innovation ecosystem analysis can be done on a region or country. This comprehensive analysis uses various specific reports to analyse key metrics[108] and is a great tool to evaluate the innovation input, output and efficiency of a specific country. This report used other reports as sources as well as surveys to gather the empirical data of the innovation ecosystem. If the given data is available and the sources are considered legitimate, a simple literature review will suffice, but for countries lacking this information, a research survey can be done to acquire the relevant information.

For the purpose of this research thesis, the innovation ecosystem analysis specifically looked at South Africa's innovation index[109]. It found that there is a strong innovation input, but lacking support and success in commercialising the innovation input into innovation output (meaning a low innovation efficiency ratio). This analysis can be complicated and is subject to various variables as discussed in Chapter 2.

The key metrics in the Innovation Ecosystem Analysis are to answer the following questions in the analysis process to evaluate the country's innovation capacity and potential gaps:

(1) *What is the country or organisation's innovation capability from a knowledge perspective?* Numerous knowledge and innovation capability and maturity models can measure this. It can also be measured as the innovation input of the country with a good ranking indicating both human and knowledge capacity.

(2) *What is the country's innovation efficacy?* This is measured as the innovation output over the innovation input of a specific country.

(3) *What is the benchmark analysis on the country in comparison to similar countries?* Measured as innovation index of the country compared to other countries performance in similar income brackets, continents and geographical position.

(4) *What is the country's innovation index area of improvements over the last few years?* Measured as the innovation index of the country over a period and can be benchmarked to other countries' performances.

(5) *What is the key metrics lagging?* Identify the strong and weak indicators similar to the benchmarking analysis. Crucial gaps can be identified this way.

(6) *What are the recommendations suggested to improve innovation index and efficiency?* Identified within the report by the authors.

[108] *Source: Cornell University, INSEAD, and WIPO (2013, p.365).*
[109] *Source: Cornell University, INSEAD, and WIPO (2013, p.244).*

7.1.2.2. ADDITIONAL: CAPACITY ANALYSES

Additional literature sources can be reviewed for more in-depth analysis of the innovation ecosystem that are not necessarily covered in the Global Innovation Index report. All internal documentation relating to a specific organisation or region should also be consulted in order to develop a more in-depth case for the specific purpose of the CVCM.

Internal analyses indicating the knowledge capital that can be generated for a specific organisation would be ideal. Furthermore, an organisation can employ more human capital to help commercialise the knowledge capital, if financial capital is available, or an internal human resources analysis can indicate whether available human resources can be repositioned for the CVCM.

7.1.3. ORGANISATION GAP ANALYSIS (WHAT)

The purpose of the organisation gap analysis is to identify any gaps within the organisations processes or systems and in the local ecosystem. This is essential to indicate internal and external detriments to indicate the various risks that the CVCM is required to mitigate or overcome.

7.1.3.1. LIFE CYCLE GAP ANALYSIS

In Chapter 2, the various support and funding mechanisms in South Africa were analysed together with its innovation index. The various components that enable an effective innovation ecosystem are required to be taken into consideration to identify any gaps within the ecosystem.

When specifically considering start-ups formed as the commercialising vehicle, it is important to understand not only the gaps in the innovation ecosystem, but also the start-up ecosystem as well. It is suggested that the Start-up Genome report is analysed to provide an overview of the country's start-up ecosystem. The key metrics in the Start-up Ecosystem Analysis are specifically looking for potential gaps and should consider the impact each gap has. In the case of South Africa, none of its start-up cities is included in the Start-up Genome report. This requires other similar reports to be investigated to find potential missing gaps.

In Chapters 2 and 4, the consideration of the start-ups' life cycle and valley of death becomes vitally important. Here the start-up life cycle gap analysis truly comes into play to analyse where gaps are that inhibit start-up growth. Key metrics in this area are difficult to find, but through interviews with industry experts and analysing the amount of support structures supporting the various phases in the life cycle, a gap analysis can be made. For the key metric of funding support, analysing the deal flow of investment by the various organisations listed on the South African Venture Capital Association are a start.

The essential aspect for this gap analysis is not to under-design the CVCF as its effectiveness to commercialise the intellectual property. Design considerations on the life cycle should only be limited to the extent of the development process as strategic partners that exist in the industry could easily fill certain roles.

7.1.3.2. ADDITIONAL: COMMERCIALISING CHALLENGES ANALYSES

In Chapter 4, the general growth challenges for start-up businesses were discussed that are an essential aspect to the analysis as start-up businesses attempt to succeed under extreme uncertainty. Essential analyses concerning growth challenges are both internal and external determinants as well as growth barriers, and enablers can be analysed, while other basic questions that can be analysed include:

- *What are the success stories in the area?*
- *What are the enabling success factors?*
- *What are the inhibiting constraints and detriments in the area?*
- *What are the risk factors that need to be mitigated?*

In this research study, general aspects were considered in the literature review, but particular aspects for a specific region or organisation can affect the impact certain growth challenges have on others. The complexity and possibilities are too wide to consider all options, especially considering the complexity surrounding the definition of business growth. However, general growth challenges can be regarded as a sufficient foundation whereby additional aspects can always be added or removed.

7.2. ORGANISATION STRUCTURE FIT (BLACK BOX)

In Chapter 5, the cooperatives as an organisational structure were discussed; where aspects that differentiate different cooperative models include hierarchy levels, degree of formality, ownership rights and type of activity. In this research study, general aspects will be considered to create a general cooperative model for the CVCF. The reasoning behind the choosing of a cooperative legal entity as the basis for the organisation structure fit can be considered as follows:

- Cooperatives are usually easy to set up and offer a reduced cost of business that involves more flexibility in the management of the business with a focus on creating value. In South Africa as an example, cooperatives as a legal entity are less subjected to legislation than other commercial entities, while associated costs of establishing and auditing cooperatives are lower.
- Cooperatives are based on output produced to receive a reward; this concept can legally be drawn up in order to support the entrepreneurial process. In other words, it means that ownership (equity) of the team members is formulated only after value is created within the start-up business that avoids imminent risks of giving equity away and not benefiting the business.
- Hybrid cooperatives can be managed in conjunction with privately owned businesses. In the case of already established privately owned businesses with different legal entities, the legal contract (e.g. term sheet and/or joint venture partnership) can be established whereby the services of the cooperative can be utilised.
- Democracy with control of rights with non-proportional voting rights which mean that each member has one vote, but leadership roles and equity structure are possible with new generation cooperatives.

However, this emphasises the cohesion between entrepreneurial team members to work together towards a common goal.

- Cooperatives have been globally associated with promoting entrepreneurship and poverty alleviation. This makes cooperatives ideal for emerging economies and in developed countries there are numerous large cooperatives that have remained globally competitive and in some cases transformed (‘*hybrid*’) into another legal entity to list on stock exchange markets.

In Chapter 3, the venture capital model was discussed and general aspects of the venture capital model will be used in the framework. Venture capital models encompass both the organisation structure and the enterprise process for funding start-up businesses. It is also important to consider the metaphor of hardware, taking a computer as an example, it is only as good as the software that can be operated on the hardware. There is a symbiosis between these two and similarly between the organisation structure fit and the enterprise innovation process for innovation to successfully be executed or implemented. In considering the symbiosis between the structuring and processes of the venture financing provided by venture capital, it is essential to reduce risks such as early investments and return of investment through implementing the portfolio effect. With the cooperatives generally regarded as a collective financing mechanism, these two organisational structures are combined to form the organisational structure fit of the CVCF.

7.2.1. BASIC COOPERATIVE VENTURE CAPITAL ORGANISATIONAL STRUCTURE

The basic formulation of the cooperative venture capital organisational structure is illustrated in Figure 7.2 below. However, the CVCF is not limited solely to this structuring, as will be discussed a little later. The only major change is that the secondary and primary cooperative legal entity is used instead of a private company. The key reason for this change is that venture capital funds and companies seek to invest into private companies that are usually already generating revenues or at least breaking even and have what is known as traction. The risk of failure has somewhat been mitigated as compared to starting a new business. This means that VCs are not the best structure for starting a new business, but are very supportive at a later stage.

When starting a new business based on research or an idea, the next step would be to put the entrepreneurial team together, develop a business case, then build the prototype and test it in the market, all of which indicates high risks of failure. In the book by Moyer (2012), the first challenge and risk clearly comes up in distributing ownership of the business. Moyer describes the inherent risk of slicing the pie (business ownership) as follows: "*You and a friend go 50/50 on a new business. You do all the work. He still owns 50% for doing nothing. Now what?"* Using a primary cooperative to form entrepreneurial teams with an initial term sheet agreement, equity structuring can take place at a later stage and can be based on the value created within the business. This means ownership does not immediately distribute and avoids that it has unnecessarily given away without any value created in the business. Each member of the entrepreneurial team has one vote and is ethically run as a democracy.

The primary cooperative is also a 'hybrid' or multipurpose cooperative meaning that it can serve numerous functions/purposes and at a later stage, it can be transformed into a private company. Note that the legal agreement in establishing the primary cooperative will run facilitated by the secondary cooperative management to protect the value provide from the CVCM.

In the case where members decide to revoke their role in the start-up business (primary cooperative), the member can go into a shadow cooperative (deregistration of member) with his value produced evaluated at that stage of the start-up business. In the case of the entire start-up business failing, the entire entrepreneurial team goes into a shadow cooperative (deregistration of cooperative) whereby the secondary cooperative pertains a '*liquidation preference'* to recover a minimum salvage value from the start-up business, if any. These aspects can all be legally structured in the governance of the CVCM.

The last scenario of forming a primary cooperative to discuss is when a start-up business with assigned equity stakes wants to join the secondary cooperative. In this case, a partnership agreement similar to a joint venture can be drawn up between the start-up business and the primary cooperative whereby the equity structure is pre-agreed upon. However, all primary cooperatives will comply with the governance of the CVCM. In this way, the start-up business gains access to the support of the CVCM while the CVCM can enforce its business model to protect its investments.

The cooperative structure used requires more detailed explanation about the typology of the cooperative model and its role, and this includes the following aspects (refer to Chapter 5 for more information):

- Its formality should be fully-fledged cooperatives that are legally registered within a specific country and usually are actively promoting the principles of cooperatives as established and governed by the laws of that country.
- A hybrid or multipurpose type of cooperative is decided on as it combines two or more types with different business activities whereby its members have a common interest and purpose. For example, a multi-stakeholder hybrid model seeking balance between conflicting needs such as consumers and producers.
- The general hierarchy level structuring of the CVCF is at least a secondary cooperative level, but a tertiary cooperative level is recommended for scaling to a regional or national level. The tertiary cooperative level can be included that provides additional investment options and diversifying of investment risks. The tertiary level will then serve a strategic and executive management role to distribute and allocate resources to different CVCMs.
- Ownership rights and new generation cooperative models that are decided has three options to select from, namely, the investor-orientated cooperatives (public traded common stock), invest share cooperatives (outside equity in cooperatives) and cooperatives with capital seeking entities (outside equity not in cooperatives). The best decision for the CVCF is to use a combination of these new generation cooperative models and is dependent on the hierarchy level of the CVCF.

- Initially, the cooperative ownership rights are recommended to form the secondary cooperative as a capital seeking entities (e.g. investment fund or trust) to raise capital and provide investors with a return on investment though a portfolio effect of a pipeline.
- The primary cooperatives, on the other hand, is recommended to form an invest share cooperatives (outside equity in cooperatives) whereby shareholding is structured for value add and specifically the investments made by the secondary cooperative into the primary cooperative. However, no equity is exchanged initially until the entrepreneurial teams have created value, but this will be structured in a term sheet agreement as the primary cooperative is established whereby expectations and different roles for prescribed shareholding is structured.
- Lastly, with a fully fledged tertiary cooperative level in operation with multiple secondary portfolio cooperatives, a strategic decision can be considered for developing an investor-orientated cooperative (public traded common stock) model. A public traded common stock system can provide a more flexible capitalisation mechanism, but is restricted by the prospectus each portfolio fund invests in which adds to complexity[110].

The role of the secondary cooperative is essentially to manage the portfolio of invested start-up businesses from an idea/research stage through to early stage. The process through which the entrepreneurial teams will be supported is discussed in the section on enterprise innovation process below, but intrinsically forms part of the organisational structure. The role of the primary cooperative is to form and develop the entrepreneurial teams as discussed above in more detail, while the role of the potential tertiary cooperative is to add an additional level of scalability and governance at a regional or national level.

[110] *Notably, the complexity is increased by the prospectus which requires additional legal auditing and costs in order to avoid illegal solicitation of funds from the public.*

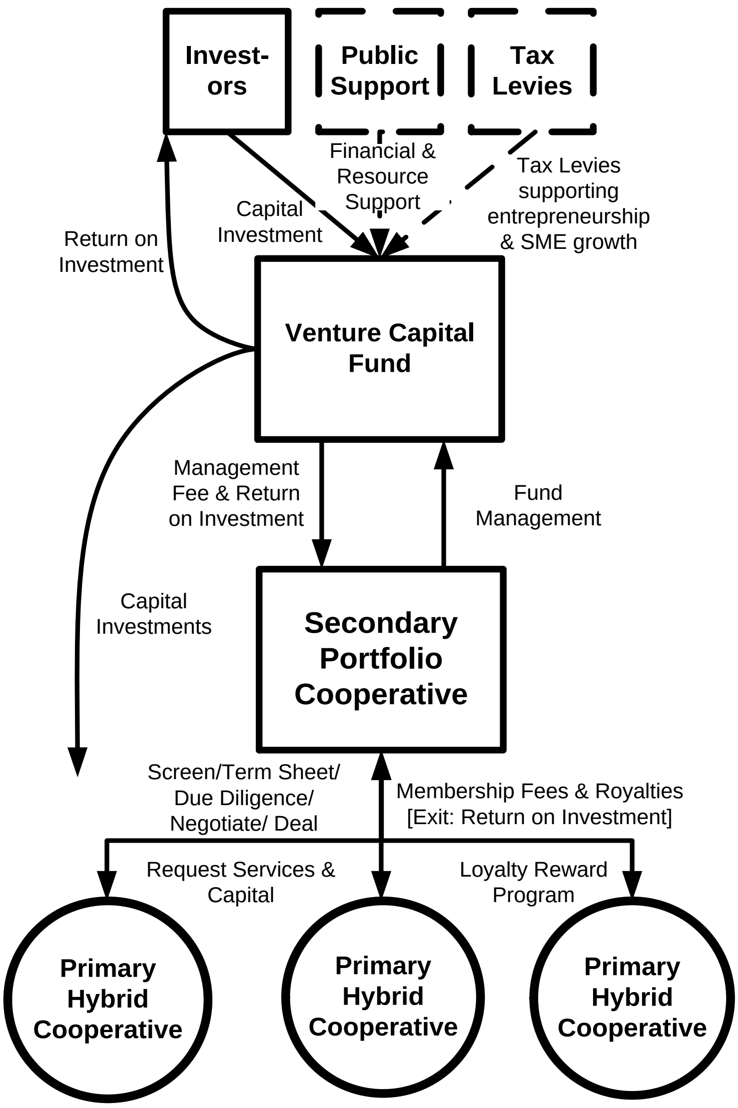


Figure 7.2: Basis of the Cooperative Venture Capital Organisational Structure

7.2.2. THE ORGANISATION STRUCTURE FIT MATRIX

In order to identify and structure the various key stakeholders that form part of the organisation structure of the CVCF, a matrix is created dividing potential stakeholders into top, middle and bottom management as a vertical axis, while dividing the horizontal axis into funding support, management and execution, key partnerships, and cooperative administration. This is synthesised and illustrated in Figure 7.3 with the horizontal axis being divided into four main areas that are defined as follows:

- **Funding Support:** These are mainly investors that invest into an investment fund seeking high rates of return on their investments. All investors will come in at the top level to the CVCF while other funding mechanisms such as crowdfunding can be used for smaller amounts at the bottom level. At a later stage with a tertiary cooperative structure, additional investing options to investors can be provided for both national and regional portfolios.

- **Management & Execution:** The management and executives are divided into three levels, which aim eventually to establish a portfolio of regional and/or national investment opportunities. The approach will lead to a bottom-up and top-down management style approach whereby top management enables the structure and environment and bottom management enables successful portfolios The three levels are namely:
    - *Regional or national portfolio management (top or tertiary cooperative level):* The role of the regional or national portfolio managers is to establish investment funds in specific regions and/or manage the national portfolio (depending on scale). They should also source and establish the necessary strategic partnerships to support the scaling while specifically look at employing specialists to manage the culture and maintain membership participation.
    - *Portfolio management (middle or secondary cooperative level):* Their role is to support and enable the various entrepreneurial teams to take their ideas and inventions successfully to market. They should also establish investment funds, raise the necessary funding, and source the necessary general partnerships and collaborations for addition support.
    - *Start-up management (bottom or primary cooperative level):* The role of start-up managers is to establish entrepreneurial teams and create value through taking ideas and inventions to market.
- **Key Partnerships:** The reason for key partnerships as a separate category is to identify key resources and activities in the business model and organisational structure that will enable the successful implementation of the CVCM. The key partnership is also divided into three levels, namely, strategic partners, general partners and collaborating catalyst projects.
    - *Strategic partners:* Partners that are identified as essential for implementing a regional and/or national portfolio that can supply services or access to funding at a regional or nationwide level.
    - *General partners:* Any partners that are identified as essential services that can enable entrepreneurial teams to grow. These services can be seen as cost-effective and existing in the market that will not be required to provide internally by the CVCM.
    - *Collaborating catalyst projects:* These are essential projects that are identified for numerous reasons (e.g. marketing, member acquisition, idea filters, team development and culture) that can act as a catalyst in enabling the growth of the CVCM. Collaborating partners can be established with entities in the market already providing such services whereby both parties can mutually benefit.
- **Cooperative Administration:** Due to the challenge of complexity in managing fast scaling and large cooperatives, a dedicated management role for cooperative administration is required. This specialist management area will also be divided into three levels, namely, organisation cultural management (top level), general cooperative administration (middle level) and catalyst project administration (bottom level, including event, marketing and public relationships).

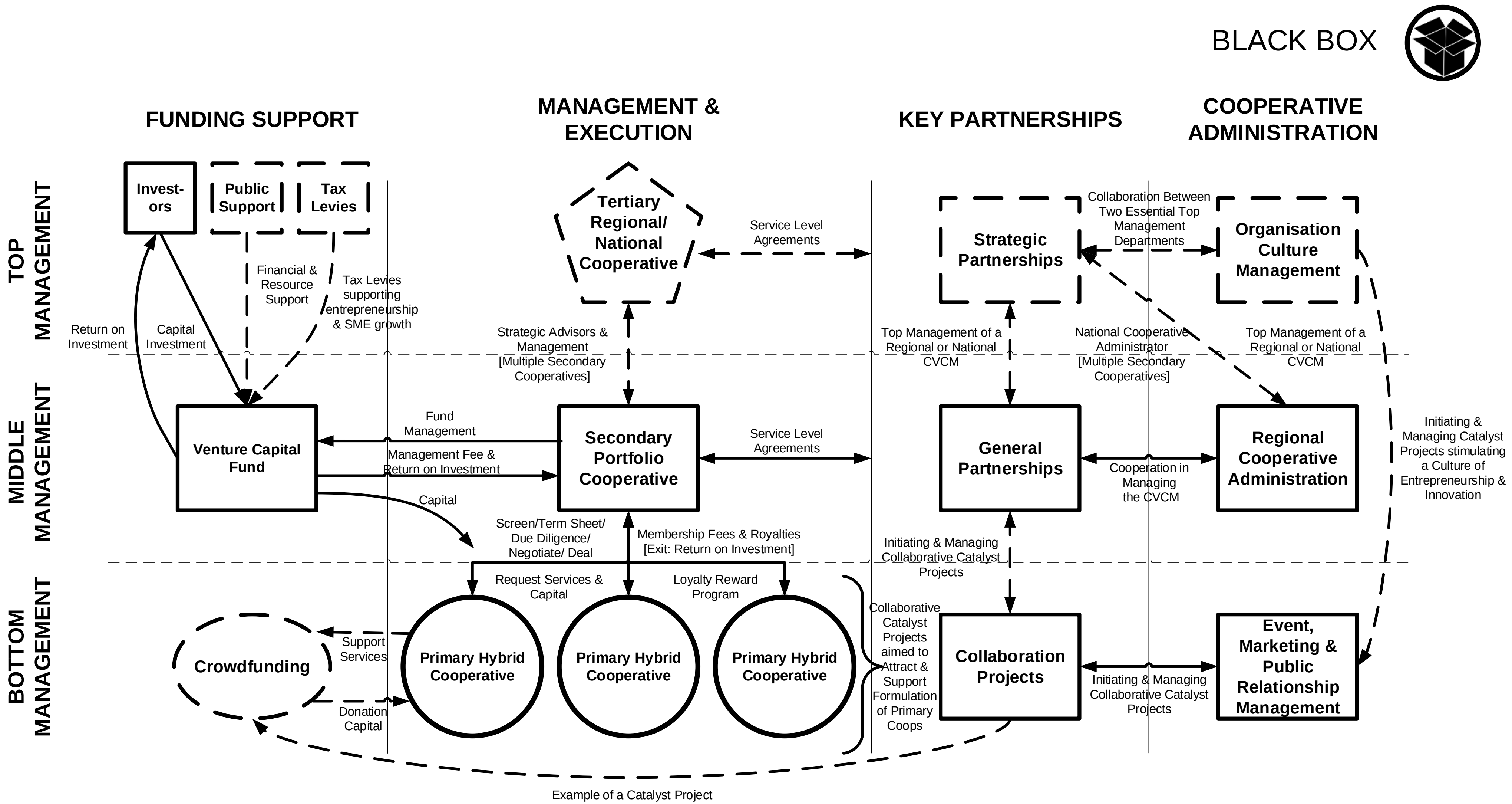


Figure 7.3: The General CVCF Organisation Structure Fit

7.3. ENTERPRISE INNOVATION PROCESS (BLACK BOX)

In the literature review, the selected best practice models and tools in innovation and strategic management, specifically for small and start-up businesses, includes the Fugle innovation model, the lean start-up methodology, the strategic fit model, the absorption capacity growth model, the experimental board tool, and the business model canvas tool, as well as aspects of the venture capital process. These models will be used and integrated into the completed process.

The literature also identified important design criteria while the defined objective and purpose of the enterprise innovation process will contribute to the core focus of the process on supporting entrepreneurship and innovation. With this in mind, key assumptions and aspects were discussed in Chapter 6 that formed the basis. This section then discusses the integrated support to the entrepreneurial teams, which are then followed by a complete process as illustrated in Figure 7.5.

7.3.1. FOUNDATIONAL PRINCIPLES

The foundation of the enterprise innovation process, as discussed in Chapter 6, is rooted on four principal components, which are as follows:

- **(1)** Start-up businesses growth and standardised financial roadmap;
- **(2)** Start-up business growth challenges and gaps (valley of death);
- **(3)** Business incubators support programmes;
- **(4)** CVCM management and executive's role and high-level functions.

The standardised financial roadmap of a start-up business as it grows **(1)** is regarded as a basis for the enterprise innovation process because, simply put, financial success is what all start-up businesses are after. It is also important as it is regarded as one of the most severe challenges start-up businesses face. In Chapter 2 (refer to Table 2.22) the standardised financial roadmap of a start-up business is discussed with particular focus on the type of funding available at each stage[111], as well as the revenue, cashflow and net income generally expected at the different stages.

The emphasis on the start-up business financial roadmap is to root enterprise innovation process on the understanding that investment is required to create value within the business. This inherent risk and monitoring of cashflow is of utmost importance in managing to reach break-even while striving to increase revenue and net income in the longer run. The golden rule of reaching the thousand days' milestone remains important with the understanding that it takes time for start-up businesses to break through the break-even mark and produce net

[111] *The CVCM uses 'states' which will be explained later in the discussion on growth models of start-up businesses. The stages of business development are flawed in its linearity and simplicity, but for illustration purposes serves its purpose. Refer to Chapter 4: Lean Growth Methodology for more detail on the growth states model.*

income in the end. This indicates that the CVCM will also only begin to yield net income in the longer run with a conservative expectation aiming between 7 to 10 years that is slightly longer than venture capital funds.

The start-up business growth challenges and gaps **(2)** as a foundation are important to emphasise the reality of the high-risk environment and what risks are required to be mitigated or overcome. The enterprise innovation process is also specifically focused on taking intellectual property generated from the publicly funded universities through to commercialisation. This means that the highest number of challenges that are required to be overcome range in the stages from research to early stage. This is also where the biggest market opportunity lies in high-risk investment and support seeing that this includes the most '*valleys of death'* (funding gaps). The key is not to overdevelop the process and focus on where the need is to promote effective commercialisation which is why the process only extends to initial revenue (traction) and early stage investments (if needed).

The business incubator support programme **(3)** is similarly focused on emphasising start-up businesses overcoming and mitigating risks and is important to reducing the cost of business. These can be considered as typical services that business incubator programmes use to support their incubating start-up businesses which range from infrastructure to mentoring, to access to networks. Either these incubator support services can offer continuous support through the business growth cycles or on request when required. It is essential that each CVCM identifies which of these services are regarded as continuous or on demand. These services can also be formed using collaborative projects, seeking specialist services that involve general partnership agreements, while identified strategic partnerships can be established that are essential for scaling the CVCM.

The CVCM management will be continuously managing the high-level functions of the CVCM **(4)** which include:

- ***Strategic Management:*** The management of the CVCM must develop and identify strategic initiatives in order to implement the CVCM. It must also continuously apply strategic management best practices throughout the lifecycle of the CVCM to acquire entrepreneurs and to support entrepreneurial teams.
- ***Information and Knowledge Management:*** The CVCM management concerning information and knowledge management considers the flow and documentation of information, the transformation of information into knowledge, and the administration and documentation of information regarding cooperative organisation structure. Refer to section 4.2 for more information on the integration support of the information and knowledge management.
- ***Organisational Structure and Process Management:*** The CVCM management responsibility, together with the information technology back-end platform and the cooperative administrators, is to design, implement and manage the organisational structuring and supporting processes supporting the entrepreneurial teams.
- ***People and Culture Management:*** The CVCM management is also responsible for the managing of entrepreneurial teams to guide them through the organisational processes and systems. From a cultural management perspective, there are three considerations, namely, community of practice and

expertise[112], culture of winning[113] and spirit of innovation[114]. These aspects are identified as important, but outside the scope of this research study and are only briefly mentioned.

7.3.2. INTEGRATING CRITICAL SUPPORT

This section aims to discuss selected aspects in more detail about the integration of critical support within the enterprise innovation process and organisation structure fit. The selected aspects are considered as important to be discussed in more detail, but also to illustrate conceptually how they would play a role in the CVCM. These supporting components include:

- **(1)** The information technology (IT) back-end platform supporting the information and knowledge management of the enterprise innovation process and organisation structure;
- **(2)** Integrated knowledge networks and the role of the information and knowledge management;
- **(3)** The role of catalyst collaborative projects supporting the enterprise innovation process.

The IT back-end platform **(1)**, does not solely provide the knowledge management solution, but technologically supports and enables information documentation, communication and administration. The documentation, communication and administration enables information flow throughout the enterprise innovation process. The cooperative administration will also use an IT platform that enables the documenting and tracking of the various stakeholders involved in the organisational structure. This platform can then be used for information flow whereby educational value can be added. Refer to Figure 7.4 below for the conceptual illustration of the information flow in terms of the enterprise innovation process.

The integrated knowledge networks **(2)** with regards to information and knowledge management consists of two main components, the IT back-end platform assisting information flow and collaborative catalyst projects. The role of information and knowledge management is aimed at supporting knowledge creation through integration knowledge networks as catalyst projects. This will be achieved through developing multiple knowledge networks that are identified as important in the development of the entrepreneurial teams. The information transfer will be transferred using the IT back-end platform while the collaborative catalyst projects will be used to implement the knowledge networks.

The collaborative catalyst projects **(3)** essentially aim to implement knowledge networks through providing networking activities and projects that allow entrepreneurs and innovators access to ideation workshops, innovation networks, professional networks, investor networks and joint venture networks. These are all opportunities for collaboration, but also networking activities to the entrepreneurs and innovators to expand

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[112] *The community of practice and expertise are considered as part of the integrated knowledge networks that are aimed at creating a community within the CVCM to specialise in innovation and entrepreneurship. Refer to Figure 7.4 below for a conceptual illustration.*

[113] *The culture of winning considers creating an environment where failing forward is accepted and provides a constant motivation to succeed culture. This can be considered as similar to corporate culture and will use branding, marketing and design of organisational structures and processes to illustrate this culture.*

[114] *The spirit of innovation considers putting underlining values that emphasise exponential thinking in terms of innovation to take on ambitious projects.*

their knowledge while entrepreneurial teams can leverage their resources and networks to create value within their start-up businesses.

Therefore, this enterprise innovation process involves the business incubator support programme together with the catalyst projects that are used as a mechanism to expand the knowledge of the entrepreneurial teams and create value in their start-up businesses. This value stream of knowledge supply, and use of integrated knowledge networks are conceptually illustrated in Figure 7.4 below. The business growth stages are illustrated as linear, but due to the nature of this growth process, it is only roughly used as an indication to what stages the various role players and knowledge networks will come into play. Note that various aspects are a continuous iterative process.

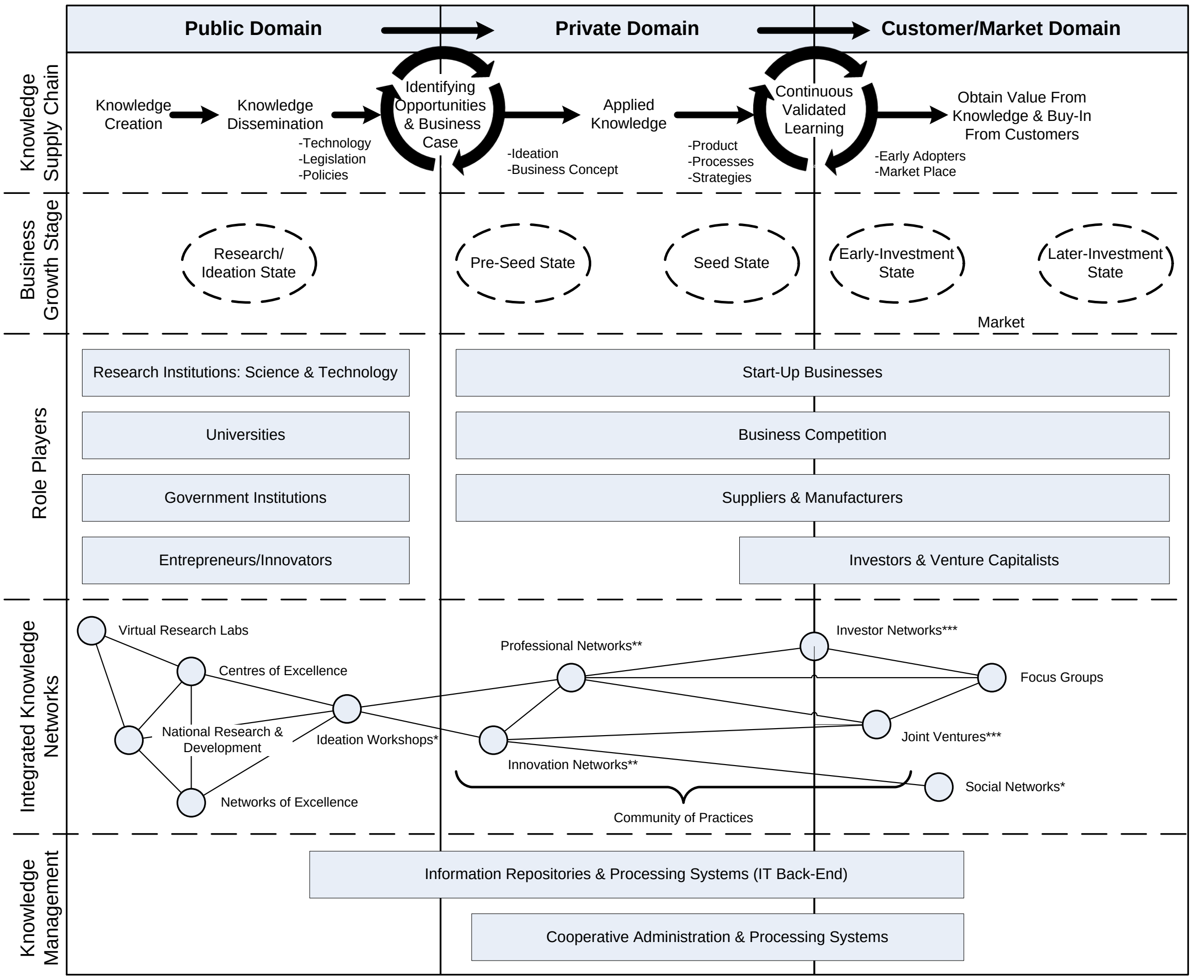

Figure 7.4: The Knowledge Flow Network of the CVCM

7.3.3. THE ENTERPRISE INNOVATION PROCESS

The enterprise innovation process is synthesised with four parallel run components namely, management and investors, financing growth, supporting growth and innovation and strategic model. This is conceptually illustrated in Figure 7.5 below and is based on the foundation components mentioned above in section 4.1. The enterprise innovation process components are defined as follows:

- **Management and Investors:** The management and investors component is discussed in section 4.1 (p. 11) above, as the role of the CVCM management and executives. The CVCM is specifically aimed at only supporting entrepreneurs from research/ideation till investment in early stage (conceptually) as existing investment entities are specifically geared towards supporting the entrepreneurial teams at those stages and beyond. In the case where other investing entities exist with an appetite for high-risk pre-seed and seed stage start-up businesses, the structure will support them as an investor.
- **Financing Growth:** The standardised financial growth component is also based on foundation principles whereby the start-up business financial roadmap and growth is considered (refer to section 4.1 on p. 11). This is based on the work by Smith *et al.* (2011, p. 20) and Van Zyl *et al.* (2013) which allows for insight into understanding the dynamics of the entrepreneurial teams better. In the case of theme or specialist CVCMs (e.g. medical industry) where profitability is subdued till regulatory approvals or any other similar reasons, the CVCM can be adapted to accommodate their needs. With regards to practical implementation, the focus is on raising the investment fund to accommodate such financial roadmaps of the start-up businesses, reducing the cost of doing business (e.g. professional services, production, manufacturing and supply chain) and leveraging the necessary networks to achieve the support needed.
- **Supporting Growth:** In order to promote effective growth support, a business incubator[115] model is used as it is specifically designed to support and accelerate start-up business growth. The aim is to reduce the cost of business in building a start-up business and providing access to knowledge networks that the entrepreneurial team can leverage for growth. These supporting structures are also possible revenue streams for the CVCM as service agreements with general partners and/or strategic partners can enable such deals (e.g. intellectual property services such as freedom to operate). Furthermore, benchmarking of business incubators[116] can be evaluated to measure performance. These growth supporting activities are also discussed in more detail below.
- **Innovation and Strategic Model:** Is the core of the enterprise innovation process as the actual strategies the entrepreneurial teams should employ to foster growth. This includes suggested tools and

[115] According to Entrepreneur Media Inc. (2014) the definition of a business incubator: *"An organization designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections."*
[116] For example, National Business Incubation Association (NBIA), 2008. *Benchmark Your Incubator Management Practices- and Access Tools for Continuous Improvement*. [Online] Available at https://www.nbia.org/resource_library/peer/benchmark/index.php [Accessed 20 October 2014].

the best practice growth models for growing innovative start-up businesses from literature. It involves different models at different business states while running parallel with the business support process to enable growth. This process is also discussed in more detail below.

The supporting growth component is further divided into three subcomponents, namely, sequential process support, continuous support, and supporting knowledge networks. They are defined as follows:

- **Sequential Process Support:** These support processes and activities follow sequentially and are not necessarily or usually used continuously. Entrepreneurial teams are generally advised to follow these as a sequence of steps in forming the start-up business ready for early state/stage investment.
    - **Prospect Pitching:** The initial invention/business idea is conceptualised and communicated to a panel of experts to filter a large inflow of business ideas. Pitching the business idea also initially conceptualises the prospective business case that is to be considered for commercialising.
    - **Founding Team:** The next step would be formalised by the entrepreneurial team that is formed to commercialise the prospective business case. Entrepreneurial teams are considered essential in forming the primary cooperative and the term sheet agreement among the founding members and the CVCM with regards to expectations, outputs and equity (once start-up is formalised).
    - **Business Basics and Etiquette:** This is essential information on the basics of doing business such as registering a company and complying with tax, as well as developing ethical practices in doing business. The information can be provided through online documents or workshops while ethical business etiquette can be incorporated in the CVCM culture.
    - **Intellectual Property Protection Management:** An intellectual property protection strategy or at least the freedom to operate the evaluation is required; especially in innovative entrepreneurial start-ups, to support future growth in highly competitive markets. These services are generally outsourced to legal companies specialising in intellectual property.
    - **Rapid Prototyping and New Product Development:** This is vitally essential to most start-up businesses in reducing the cost of doing business. Rapid prototyping and new product development services essentially allow entrepreneurial teams to build products quickly and cheaply to test market validation early before scaling up costly business processes. It also aligns with the lean start-up methodology while new technology has made manufacturing possible and cost-effective anywhere in the world. These services can also be outsourced to specialists in the field and internal services can be considered for the development of the CVCM.
    - **Contract Management:** This includes setting up contractual agreements between manufacturers, suppliers and investors. It also includes aspects such as terms and conditions between the start-up business and its customers.

- **Coaching, Mentoring and Advisory Board:** All entrepreneurial teams can also gain substantially from additional business coaches and personally gain from mentoring. These industry experts are often also suitable for the advisory board once the start-up business has grown. The role of the advisory board is to help guide the start-up business in order to benefit from the knowledge of others, without the expense or formality of the Board of Directors.
- **Management and Talent Acquisition:** This is another service that can be crucial to all start-up businesses as acquiring the talent and human resources supports growth.

- **Continuous Support:** These are business incubator support services that are provided continuously as requested on demand by the entrepreneurial teams. They are not necessarily all in-house and can be outsourced to specialist service providers.
  - **Infrastructure and High Speed Internet:** This involves the necessary infrastructure such as office space in which the entrepreneurial teams can build and test their ideas as they grow their start-up businesses. This will also include providing high-speed internet to entrepreneurial teams, especially if the CVCM is focused on e-commerce start-up businesses.
  - **Business Training Programme:** Educational support programmes and training on different aspects of start-up businesses ranging from ideation techniques, to manufacturing processes, as well as practical aspects such as registering a company and applying for tax. These training programmes can be run as continuous workshops throughout a given calendar year or period.
  - **Design, Branding and Marketing:** These are either services that entrepreneurial teams can utilise internally through employing the respective skills or outsource the services on demand to experts in the field as required. These services can also include specialised marketing fields such as Search Engine Optimisation that are especially utilised in e-commerce start-up businesses.
  - **Accounting/Financial and Legal Management:** As mentioned, the financial roadmap for start-up businesses is especially important, which is why continuous financial management is required. The same goes for legal management and similar services such as contract management, but also other more specialised as in organisational structuring.
  - **Technology Commercialisation Assistance:** These support services are specifically aimed at transferring experience and assisting the entrepreneurial teams in commercialising their technology.
  - **Early Adopters and Customer Acquisition:** These involve providing entrepreneurial teams with the opportunity to test their products/services in the marketplace that can give start-up businesses access to early adopters and customers.
  - **Grants, Bank Loans and Loan Funds:** These support services are specifically aimed at transferring experience and knowledge to the entrepreneurial teams in aspects such as applying and accessing grants and loans.
- **Supporting Knowledge Networks:** The role of integrating knowledge networks is specifically aimed at supporting the transfer of experience and knowledge within the community of expertise. It is also

aimed at developing and supporting the culture of the community as well as promoting the spirit of entrepreneurship and innovation. Refer to Chapter 5 for more information of the respective knowledge networks.

- **Ideation Workshops:** This workshop is aimed at creatively developing a business case and to conceptualise the business concept. In Chapter 3 and Chapter 4, innovation and entrepreneurial approaches are discussed whereby the most effective approach can be determined based on the resources and networks available.
- **Community of Practice (CoP):** The entrepreneurial teams are regarded as the community members building specific capabilities within their domain and market. In the case of themed CVCMs the CoP can easily be expanded further with specific additional knowledge networks in support of the CoP. This becomes slightly harder with a more diverse range of entrepreneurial teams in different domains and markets, but the generic business training education further supports the CoP.
- **Professional Networks:** This specific knowledge network combines both the purpose of community of practice and competence networks to develop a professional network whose members' knowledge, experience and expertise can assist in the commercialisation process. These formal networks involve commercial negotiation of respective member's services.
- **Innovation Networks:** Involves multiple organisations that support the commercialisation process of innovative ideas. This is usually specialised and domain dependent networks, but together with a professional and investor networks, the commercialisation process can be further supported. Technology transfer offices in particular play a vital role with already established networks and relationships.
- **Investor Networks:** These are networks of wealthy individuals that are interested in investing capital into start-up businesses with the understanding of the high risks associated and respective returns. In particular, universities can involve their alumni network to promote philanthropy and provide additional value to their alumni network.
- **Joint Venture and Strategic Partner Networks:** These involve specific organisations that can assist the entrepreneurial teams as a strategic partner or through entering into a joint venture that is aimed at commercialising the technology or intellectual property. It is specifically important to develop a commercial case, as some technologies require too large an investment to become commercially viable and require a '*big brother'* (strategic partner) that can assist in the financial burden.
- **Social Networks:** These are merely important to promote and support the culture of the community and attain a sense of belonging through collaboration with its members.

The innovation and strategic model is further numbered in Figure 7.5 below to emphasise key components aligned with the other parallel processes. These are described next and include the following:

- **Basic Research and Ideation (1):** This involves the founding members formulating the business concept and case. University research and outside entrepreneurs can utilise the initial resources of the CVCM, such as networking, ideation workshops and business training workshops. It is essential is to receive early feedback on business concepts to test initial viability and filter through concepts that are not ready to progress into the next state. Useful tools include the Business Model Canvas (refer to Chapter 5).
- **Entrepreneurial Teams and Primary Cooperatives (2):** Once a promising business case is developed, the entrepreneurial team should be formed, and the primary cooperative should be registered. With the buy-in from other members, an initial peer review is automatically done which from the CVCM perspective only requires further support to test the concept truly within the market.
- **The Lean Start-up Methodology (3):** In Chapter 4, the Lean Start-up methodology was discussed extensively including tools such as the Experimental board and Business Model Canvas, which are regarded as continuous validated learning processes that best fit the growth process of start-up businesses. This will form part of the business training workshops, and it is advised that entrepreneurial teams apply the lean concepts and principles to their business concept.
- **Strategic Fit (4):** In Chapter 4, the Strategic Fit is described and it is an essential tool that can be used together with the Business Model Canvas to identify scenarios and strategies that will help entrepreneurial teams to effectively test their business assumptions, but also to evaluate what is required for implementation.
- **Lean Growth Methodology (5):** This methodology combines both the Lean Start-up methodology and the Business Growth States Absorption Capacity model to continuously use the validated learning while building the capacity of the start-up business. These two methodologies essentially help identify and mitigate risks. Refer to Chapter 4 for the complete summary of the Lean Growth Methodology.
- **Investment Readiness (6):** This involves start-up business planning its financial roadmap and preparing for investor network activities. The necessary documentation, pitching and exit strategy should be prepared continuously, but should be finalised for the specific investors.
- **Continued Growth and Exit Strategy (7):** Once investment has successfully been acquired; the business operations are expanded to scale into other markets aiming to gain market share. The Business Growth States Absorption Capacity model can still be continuously used while the Lean Start-up methodology remains fundamental in testing assumptions. The aim of the scaling should also be aligned with the exit strategy.

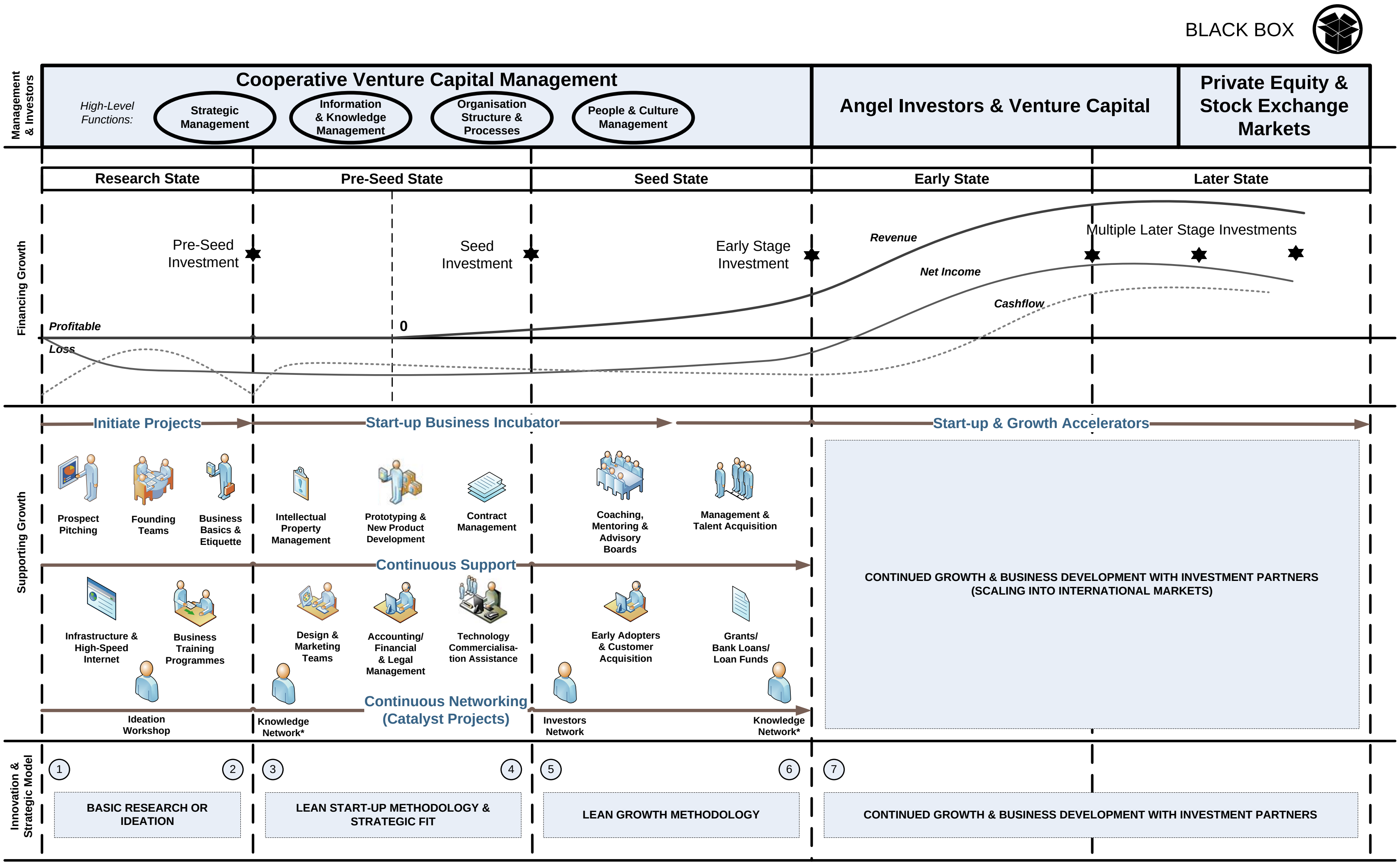

Figure 7.5: The Enterprise Innovation Process

7.4. ENTERPRISE FUNCTIONAL SYNTHESIS (OUTPUT)

The enterprise functional synthesis is divided into three main aspects, namely, standardise CVCM (minimum) expected output, the enterprise engineering structural component checklist, and the setting of key performance indicators for measuring implementation. The standardised CVCM (minimum) expected output is synthesised as the basic organisation structure fits together with the basic enterprise innovation process required for a defined purpose.

The second aspect is the enterprise engineering structural component checklist defined in Chapter 6, which should be used to check that the enterprise functional synthesis is aligned with the enterprise engineering principles. The structural component checklist is defined as six principles with subcomponents relating to the alignment of the CVCF. This is synthesised in Chapter 6; refer to Table 6.9 for the specific details of the checklist.

The third aspect involves the defining of the specific key performance indicators for measuring the successfulness of the CVCM implemented. The KPIs will not only be for various departments of the CVCM, but also aligned with the purpose and objectives of the CVCM. The overall KPIs that all CVCMs should strive towards are the following:

- The number of individuals, ideas and intellectual property entered or identified against the number of entrepreneurial teams formed/entered forming primary cooperatives with the aim around 40–60%.
- The number of entrepreneurial teams formed/entered to receive early stage investments e.g. venture capital financing, with the aim around 40–60%.
- The number of entrepreneurial teams formed/entered to reach financial breakeven and initial net income within a given period (1–3 years) with the aim around 60–80%.
- The number of entrepreneurial teams not achieving breakeven and market viability fails within a specified period is perished within a very short period with the aim around 6 months. The objective here is to test quickly to fail quickly to reduce excessive costs and time wasted and to get to the successful opportunities quicker.

Additional benchmarking of the enterprise innovation process and organisation structure of the CVCM can be determined based on international business incubator benchmarks. The National Business Incubator Association (NBIA) is an example of a large benchmark database that can be used. Another method would be to collaborate with business incubators in the country or with international country business incubators within the organisation's network. A case study example of the Stellenbosch University ecosystem will better explain and illustrate the functional output as an example.

7.5. CASE STUDY EXAMPLE: STELLENBOSCH UNIVERSITY ECOSYSTEM

This section will be comprised of the application of the CVCF on the Stellenbosch University in South Africa as a case study. The key stakeholders directly involved at the Stellenbosch University ecosystem are divided into four main categories for developing the CVCM. These stakeholders are grouped and include the following (Stellenbosch University, 2013):

- **Management and Executives:** This consists of the Statutory Bodies and more specifically the Council of Stellenbosch University. The Council[117] and its elected management members fall under the Higher Education Act, the SU Statute and other applicable legislation, with the responsibility for operational and academic issues, as well as institutional policy and strategy.
- **Academic Research and Innovation:** This includes the different research academic departments at Stellenbosch University as well as specific entities focusing on innovative research. The fields of research producing intellectual property[118] worth licencing and formulating spin-off companies are agri-sciences, engineering, life sciences, medicine and health, physical sciences and green energy.
- **Technology Transfer Office and Incubator:** The technology transfer office of Stellenbosch is Innovus and in 2013, a newly formed business incubator, the LaunchLab was launched under the management of Innovus. Innovus is a registered (Pty) Ltd (limited liability company) and is owned by the University of Stellenbosch.
- **Industry Partners and Alumni:** These include graduated alumni members of Stellenbosch University active as donors and supporting the University, while industry partners include any contractual partnerships for research and innovation purposes between organisations and the University.

This case study is compiled from data available online on Stellenbosch University and its respective stakeholders while interviews with the relevant management, entrepreneurs and innovators were conducted.

7.5.1. CAPACITY AND GAP ANALYSIS (INPUT)

The input analysis on Stellenbosch University is mainly compiled from data available and is extensively discussed in Chapter 2 from a macro South African perspective. The additional market research was conducted for capacity and gap analysis purposes with entrepreneurs, innovators and business developers through structured interviews in order to develop a better understanding of their needs.

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[117] The list of Council members and their respective functions are described on Stellenbosch University, 2014. *Council*. [Online] Available at http://www.sun.ac.za/english/management/statutory-bodies/council [Accessed on 20 October 2014].

[118] Innovus, 2014. *Technology Available For Licensing.* [Online] Available at http://www.innovus.co.za/pages/english/technology/technology-available-for-licensing.php [Accessed on 20 October 2014].

7.5.1.1. ORGANISATION FRAMEWORK PURPOSE ANALYSIS (WHY)

The purpose of the Stellenbosch University Cooperative Venture Capital Model (SUCVCM) is specifically to develop an organisation to promote effective commercialisation processes of Stellenbosch University intellectual property. In Table 7.2 below, a brief purpose analysis of the SUCVCM illustrates a basic example and uses the SUCVCM as a develop brand identity and entity.

Table 7.2: Stellenbosch University Cooperative Venture Capital Model Purpose Analysis

Purpose		Statement
Vision		SUCVCM aims to become the leading source of exponential technologies in South Africa with lasting global impact. It will achieve this through becoming a hub that educates, inspires and accelerates a community of entrepreneurs to the next level through supporting the commercialisation value stream.
Mission	*Strategy*	The SUCVCM has a ten-year strategy to develop a pipeline for exponential technologies with three specialised departments[119], namely, sciences and technology, e-commerce and IT, and social development that will enable entrepreneurial teams to have a global impact. The department of sciences and technology will focus on providing support towards the fields of agri-sciences, life sciences, medicine and health, physical sciences, engineering and green energy. The e-commerce and IT department will focus on providing support to entrepreneurial teams in the field of information technology and engineering relating to e-commerce. Then the social development department will focus on supporting social innovation and entrepreneurial teams that can have an impact in their direct society, but not necessary global scalability.
	Tactics	The SUCVCM aim is to within a year implement the basic CVCM required and have the first batch of entrepreneurial teams run through the enterprise innovation process and programmes within at least the targeted fields.
Values		The seven principles and objectives of cooperatives (discussed in Chapter 5), as well as Stellenbosch University ethical standards.

7.5.1.2. ORGANISATION CAPACITY ANALYSIS (HOW)

The organisation capacity analysis specifically looks at the knowledge and human capacity to drive the SUCVCM. Two specific capacity analyses are considered, namely, an innovation ecosystem analysis and Stellenbosch University capacity analysis.

[119] Portfolio of research output and inventions by Innovus (Pty) Ltd, 2014. *Technology Available for Licensing*. [Online] Available at http://www.innovus.co.za/pages/english/technology/technology-available-for-licensing.php [Accessed 30 October 2014].

7.5.1.2.1. INNOVATION ECOSYSTEM ANALYSIS

In Chapter 2, the South African innovation ecosystem was analysed, and a synthesis of the Global Innovation Index is illustrated in Figure 7.6 below. The key findings on South Africa's innovation ecosystem analysis from a high-level perspective are as follows:

- South Africa is highly competitive in all domains in comparison to neighbouring countries in the Sub-Saharan Africa region, except in innovation efficiency.
- South Africa's global ranking of the mid-1950s has remained competitive with Mauritius being the other African country that is slightly more competitive.
- South Africa's innovation input has slightly declined, while the innovation output has slightly improved. However, the innovation efficiency has consistently declined and remains highly uncompetitive overall.
- Comparing South Africa to similar income type countries globally, it is evident that South Africa is only slightly competitive in terms of innovation input on a global scale. The countries that are outperforming South Africa in this category are Malaysia, China and Costa Rica. (refer to Table 2.5).

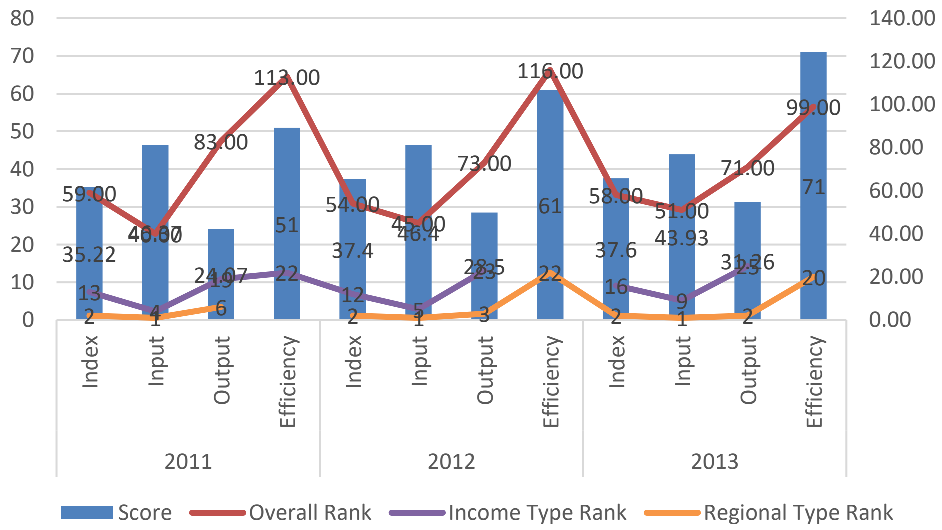


Figure 7.6: Synthesis of South Africa Innovation Ranking adapted from Global Innovation Index (2011–2013) reports

In a deeper analysis of South Africa's innovation ecosystem, the following strengths and weaknesses are tabulated in Table 7.3 below. For more information and in-depth analysis of South Africa's innovation ecosystem, refer to Chapter 2.

Table 7.3: South Africa's Detailed Innovation Ecosystem Analysis

Strengths		Weaknesses	
Category	***Notes***	**Category**	***Notes***
Institutions	*SA has a good regulatory and business environment.*	Institutions	*SA's political environment w.r.t. government effectiveness and extensive corruption that requires improvement.*
Human Capital & Research	*The top universities in SA produce good quality research and innovation input.*	Human Capital & Research	*Education, tertiary education and R&D has room for improvement as in recent year's quality standards have dropped.*
Infrastructure	*General infrastructure in SA is regarded as fairly sufficient and overall good.*	Infrastructure	*Great improvement with ICT sector, but government participation can improve, as well as ecological sustainability. Cost of business also increases with large geographical dispersion of the country.*
Market Sophistication	*SA has a strong credit and investment policies, laws and application in the market.*	Market Sophistication	*Trade and competition are another improvement area in terms of the local competition intensity, non-agricultural market access and applied tariff rates.*
Business Sophistication	*SA has good innovation linkages and knowledge absorption especially with university and industry research collaboration, and technology transfer.*	Business Sophistication	*Lack of skilled labour, serious unemployment issues and education issues further complicate business. Other weaknesses are the foreign direct investment net inflow which is rather limited*
		Knowledge & Technology Outputs	*The impact and diffusion of knowledge as new business creation and foreign direct investment net outflows are major weaknesses in need of improvement.*
		Creative Outputs	*Two areas of improvement would be Wikipedia monthly edits and YouTube video uploads, but this will automatically improve with more general access to ICT.*

7.5.1.2.2. STELLENBOSCH UNIVERSITY CAPACITY ANALYSES

Stellenbosch University was established in 1866 and is the second-oldest university in South Africa with a strong focus on being a research university. Stellenbosch University has just over 28 000 students (roughly 60% undergraduate and 40% postgraduate). It currently has ten faculties with about 150 departments, and has more than 40 research institutions.

In Chapter 2, the empirical analysis on the South African innovation ecosystem was done with the available data with specific data on Stellenbosch University being summarised in Table 7.4 below. Stellenbosch University has also seen a dramatic increase in financial support from the DHET ranging from ZAR 588 million In 2007 to ZAR

1.253 billion in 2012 (refer to Figure 2.17). The total asset[120] worth of Stellenbosch University was found to accumulate to ZAR 10.977 billion which has in recent years been on a gradual increase.

Table 7.4: Stellenbosch University Research and Teaching Output

	2007	2008	2009	2010	2011	2012	*Ave.*
Research Output	1335	1610	1731	1821	1936	2502	*1823*
Researchers	840	867	873	917	968*	1137*	*874*
Teaching Output	5285	5316	6087	6450	6389	6502	*6005*

**Adjusted values according to research output trends.*

It is clear that Stellenbosch University is a good case study as it produces a consistent competitive research output while it has a strong human capital basis. Financially the University is substantially stable with a strong asset base and support from both government grants and private donors. The technology transfer office, Innovus (Pty) Ltd has also had success as compared to other technology transfer offices in South Africa. This is not only in transferring technology through licencing deals, but also through the establishing of spin-off companies, namely:

- Geosun Africa (Pty) Ltd;
- The Stellenbosch Nanofiber Company (Pty) Ltd;
- Unistel Medical Laboratories (Pty) Ltd;
- Diacoustic Medical Devices (Pty) Ltd;
- African Sun Media;
- Stellenbosch Wind Energy Technologies (Pty) Ltd.

Stellenbosch University has established more than the above-mentioned spin-off companies, but these are the best known, while technology licencing is the more dominant activity at Stellenbosch University technology transfer office[121]. Then there is also the new business incubator, the LaunchLab[122] that has currently 15 start-up businesses it is incubating while a total of 24 start-up businesses have been through the incubator's doors in the past two years. In total the start-up businesses account for 45 members with the largest start-up business employing 6 members. These businesses are primarily in the fields of ICT, education and media, while another noteworthy aspect is that the LaunchLab incumbents provided 26 internships for students.

For the purpose of finding more in-depth market research for developing the SUCVCM, structured interviews were conducted with 13 entrepreneurs, innovators and business developers at Innovus (Pty) Ltd and the

[120] Stellenbosch University, 2013a. *Annual Report 2013*. [Online] Available at http://www.sun.ac.za/english/about-us/annual-report [Accessed 30 October 2014], and Stellenbosch University, 2013b. *Donors Report 2012/2013.* [Online] Available at http://www.sun.ac.za/english/Documents/HOPE_Docs/SU%20Donor%20Report%20Eng%20WEB.pdf#search=annual%20report%202007 [Accessed 30 October 2014]

[121] Nel (2013) Innovus (Pty) Ltd technology transfer performance for 2013 accounted for 16 licences, 14 provisional patents, 23 disclosures received and 2 spin-off companies

[122] Data provided by the LaunchLab, 2014. *Infographic: Activity Report*. LaunchLab: Stellenbosch.

LaunchLab (refer to Appendix C:1 for synthesis of data sets). The structured interviews were specifically aimed at developing a better understanding of the needs of the entrepreneurs and innovators. The analytics from the interviews with the start-up businesses showed overwhelmingly that e-commerce, software and information technology are the dominant sectors.

The start-up businesses interviewed were also predominantly seed and early stage, with two later stage businesses (refer to Figure 7.7 below), while the combined LaunchLab tenants have obtained a sum total of ZAR 5,28 million in investments, suggesting that the start-up businesses could be at more infancy stages than expected. The data could also be skewed as different entrepreneurs defining and understanding different stages differ, while compared to the NBIA benchmarks[123] and the average venture capital investment per start-up business of ZAR 8.11 million in South Africa, the amount is low.

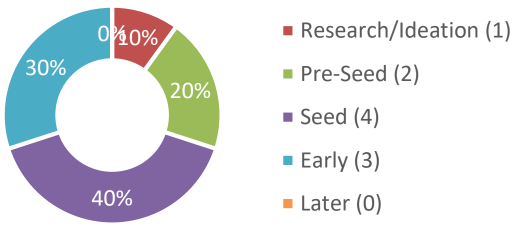


Figure 7.7: Growth Stages of LaunchLab Start-up Businesses

In Figure 7.8 below, the LaunchLab start-up and spin-off businesses' current financing sources, as well as the financing sources they are seeking at future growth stages/state are illustrated. Notably, owner's capital and angel investors are the predominant sources of financing, while two start-up businesses have received venture capital investments. The need for investment and financing options for future growth in start-up business is predominantly regarded as essential while most are seeking angel and venture capital investments that align with their respective financial roadmaps and present growth stages.

To synthesise the capacity analysis, the Stellenbosch University ecosystem generates a strong educational base providing skilled employees to the SUCVCM, while also producing world-class knowledge capital with a strong research base. It is evident that Stellenbosch University has both the knowledge capital and human capital to effectively implement the CVCM, while it can be argued that there is a need for developing a stronger commercialisation presence with all the research produced. There are also already success stories of technology transfer licences and spin-off businesses, while initial interests of entrepreneurs and innovators further emphasise the need and purpose of the SUCVCM.

[123] *NBIA (2008) benchmark for business incubators are 17 resident clients, 32 affiliate clients and 55 graduates which average 76,8 full-time resident clients employed with the programmes generating US$18,7 billion in revenue.*

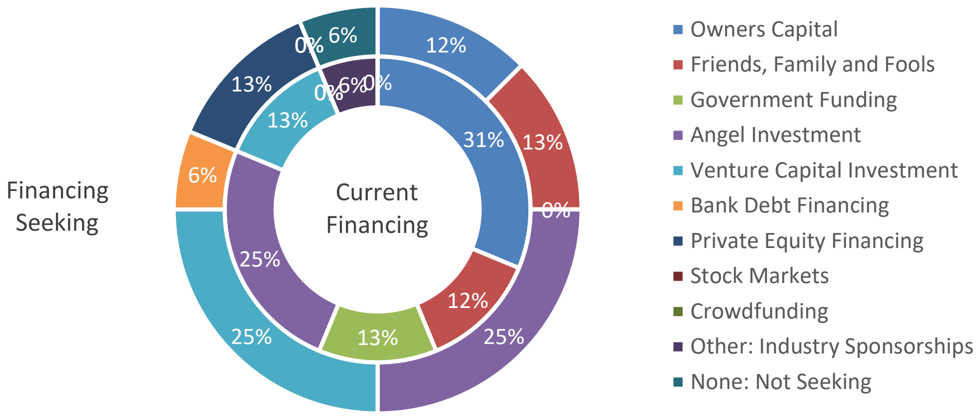


Figure 7.8: Financing Sources of LaunchLab Start-up Business

7.5.1.3. ORGANISATION GAP ANALYSIS (WHAT)

The purpose of the gap analysis in the case study of Stellenbosch University is aimed at analysing the gaps in the innovation value chain, financial roadmap of start-up businesses and innovation ecosystem. In Chapter 2, the South African start-up ecosystem was discussed, and the general innovation capital gap is illustrated in Figures 2.11–2.13. With the immaturity of South Africa's start-up ecosystem and relatively low investments by venture capital companies, it is evident that there are limited funding options available to start-up businesses. The funding gap is estimated to be primarily between middle pre-seed and beginning early stage while a secondary funding gap is estimated to between seed and early stage.

In Chapter 4, the different generic challenges start-up businesses face were discussed, and generic support services are considered in the start-up business incubation process of the CVCF. In order to identify the specific challenges the entrepreneurs in the Stellenbosch University ecosystem are facing, market research on identifying challenges and success stories are necessary, as well as the support services they deem important. This was achieved through interviews with entrepreneurs, innovators and business developers within the ecosystem.

In Figure 7.9 below, the LaunchLab tenants were asked to identify applicable challenges that they face and rank the three most severe challenges they face which was weighted to identify the most challenging. The results indicate that customer acquisition and market entry and new markets are the two most challenging challenges. It is important that none of the challenges is completely neglected, but there is a level of priority as two of the other important challenges to overcome are formulating and implementing formal systems, and obtaining financing. Notably, two additional challenges mentioned are finding suitable partner(s) and communicating the business vision to others.

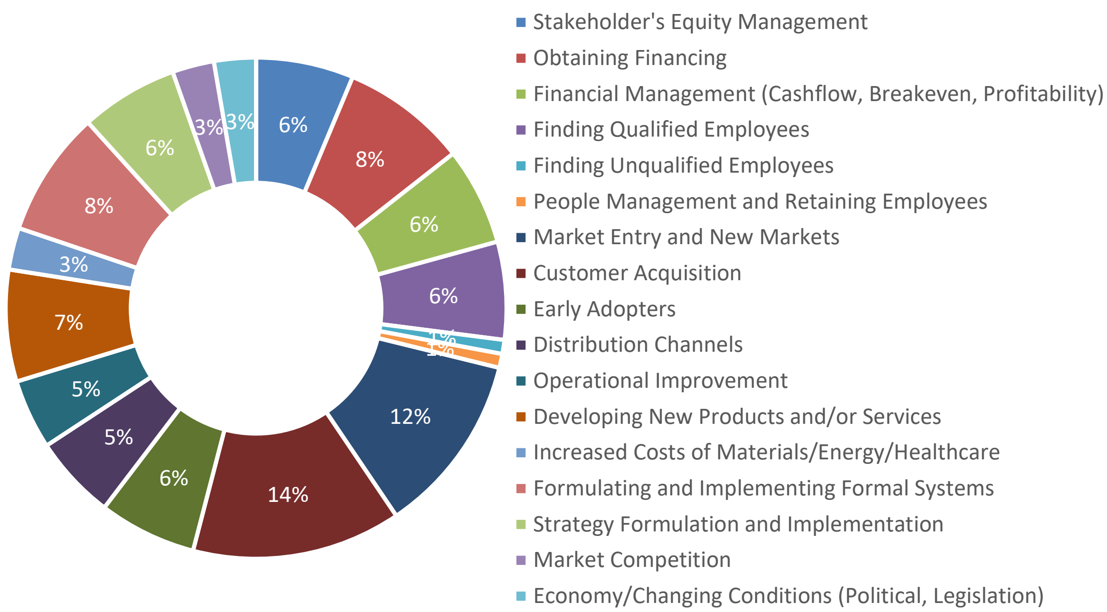


Figure 7.9: Main Challenges Identified by LaunchLab Start-up/Spin-off Businesses

In an attempt to foster greater understanding of the growth gaps in South Africa's ecosystem, the LaunchLab tenants were asked to give their perspective on whether there are any major growth gaps. Only two tenants argued that there is not any growth while another was unsure. However, the rest of the tenants argued that there is clearly a major growth gap in South Africa and contributed the flaw to the following aspects:

- Lack of regulatory support ('*red tape*') to start-up businesses to compete against larger, established businesses. For example, lack of tax incentives to start a business.
- Lack of funding for start-up businesses, especially in pre-seed, seed and early stages. This is mainly due to the immature venture capital industry, lack of exit possibilities and lack of foreign direct investment into the ecosystem, while government funding is limited for applied research and more commercialisation studies.
- Scalable market opportunities are limiting the speed of taking technologies to market to develop 'traction' while a lack of risk appetite from investors and entrepreneurs further limits striving towards global opportunities and markets.
- This immature start-up ecosystem also lacks a culture of entrepreneurship that comes from success stories and producing competent entrepreneurs, mentors and business coaches.

The LaunchLab tenants were asked to identify the relevant support services that their respective businesses require and to identify the three they regard as most important. The results were weighted and are illustrated in Figure 7.10 below, where notably none of the services was completely disregarded as important and should be considered, even if it is just outsourced by the SUCVCM. The most important support service were regarded as access to coaching, mentoring and advisory board members, followed by finding entrepreneurial team members (or partners). Then two other services, investor networks and high-speed internet ('*stable*') are equally important to provide.

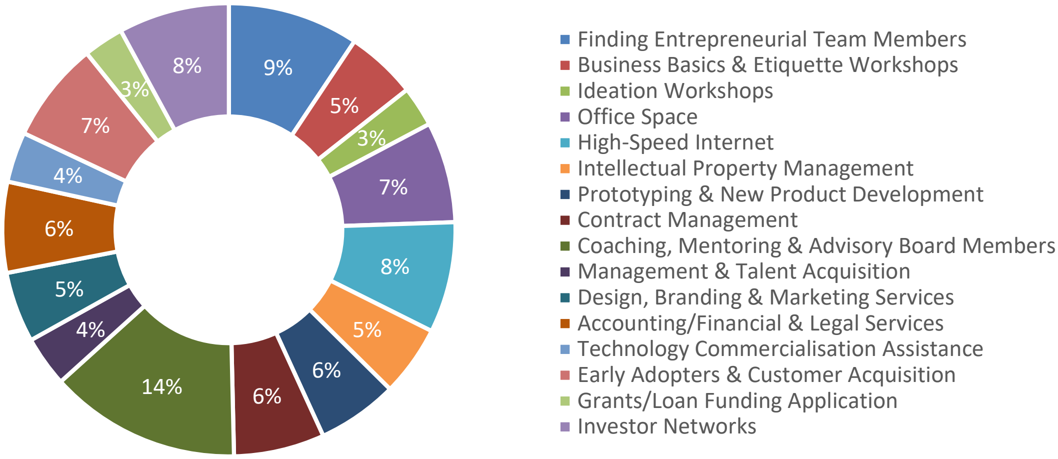


Figure 7.10: Main Support Services Identified by LaunchLab Start-up/Spin-off Businesses

To synthesise the gap analysis, it is noteworthy to highlight the major growth gaps and needs of the tenants with literature review findings. The strong consensus on the growth gaps and identified support services serves as an initial internal verification of the need for the SUCVCM as a potential alternative solution, while the alignment and correlation of the literature review and interviews supports the deductive reasoning of the CVCF.

7.5.2. ORGANISATION STRUCTURE FIT (BLACK BOX)

The organisation structure fit is developed through analysing the stakeholders and respectively filling the organisation matrix as illustrated in Figure 7.3. This organisation structure fit will only briefly be discussed and during the implementation of such a CVCM, analysis that is far more detailed and development of strategies and tactics may be required. To simplify this case study example, only a secondary cooperative hierarchy level will be used with the opportunity to rescale at a later stage. The matrix horizontal axis includes the following aspects:

- **Funding Support:** The investment fund should be a trust legal entity that provides Stellenbosch University alumni and other investors a long-term prospective financial return as a financial service provider under the National Credit Act, Companies Act and Cooperatives Act. Other fund investing streams can include industry sponsors and government funding (grants and applied research funding). This also provides Stellenbosch University students and employees with a local investment opportunity to improve their local economy. A local partnership between the LaunchLab and the crowdfunding platform, Thundafund can be used as an additional fundraising opportunity for entrepreneurial teams as well as accessing early adopters and marketing.
- **Management and Executives:** The hierarchy structure of the SUCVCM is developed, taking the following aspects into consideration:
    - There is no need for a tertiary cooperative just for the Stellenbosch University ecosystem, but NIPMO can, for example, manage a national tertiary cooperative structure that includes each public funded university.

- The management and executives of the secondary cooperative can consist of Innovus (Pty) Ltd, LaunchLab and perhaps Council managers, but must ideally remain private to the University. The secondary cooperative will also have a greater voting share of 60–70% in the allocation of funds to the primary cooperatives.
- The primary cooperatives will be classified into one of three departments (sciences and technology, e-commerce and IT, and social development) which specifically align services and resources for those specialised fields, but generic services can be shared. The reasoning behind the specialised departments is to improve and diversify the portfolio effect for investors.
- The primary cooperatives are formed with the entrepreneurial teams whereby each team allocates specific roles and mandates, as well as identifying the team leader. The human capital of the entrepreneurial teams can be formed with promising researchers/innovators, entrepreneurs, students and alumni while promising intellectual property with member participation incentives forms the knowledge capital.

- **Key Partnerships:** The key importance is to identify the general partnerships that are required to provide necessary services to support the entrepreneurial teams. Each partnership and the secondary cooperative will have a service level agreement providing partnerships access to multiple entrepreneurial teams at a reduced cost of business. The key services will be discussed in the enterprise innovation process. Existing partnerships with the University of Stellenbosch, the LaunchLab and Innovus (Pty) Ltd will also be taken into consideration. The internship programme run by the LaunchLab by providing start-up businesses with students as human resources further aids this process and can also be used for the coordination of events, public relations, etc. Collaborative projects can be run in conjunction with the various other University departments while the coordinating employees for these projects can be sourced as interns.
- **Cooperative Administration:** The main role of cooperative administration at first is to set up, coordinate and manage the information communication technology that will be used as knowledge management software. These services can be outsourced to relevant parties in South Africa that are specialising in this field. These services will come at a capital expense, but can be customised to add value further to the particular CVCM.

7.5.3. ENTERPRISE INNOVATION PROCESS (BLACK BOX)

The enterprise innovation process of the SUCVCM will mainly consist of the changes in the integrated support services to specifically address the challenges and gaps the entrepreneurs in the Stellenbosch University ecosystem face. The SUCVCM enterprise innovation process will specifically also have three departments (sciences and technology, e-commerce and IT, and social development). Each of these departments will be provided with specialist services, but certain generic services will be shared. They will also offer specialist management expertise in those fields and tailored entrepreneurial educational programmes.

The generic enterprise innovation process in Figure 7.5 above requires only slight changes through adapting the integrated process with the three different department support services of the SUCVCM. In general, the key partnerships will provide the following support services as listed in Table 7.5 below. The different alumni of Stellenbosch University together with the researchers and innovators of the respective University faculties will provide specific knowledge expertise, while successful entrepreneurs (including alumni) will make up the coaches, mentors and advisory boards, if they do not join the entrepreneurial teams.

Table 7.5: SUCVCM Key Partnerships and Respective Support Services

Key Partnerships	Support Services
Stellenbosch University:	
• **Faculties: Agri-Sciences, Engineering (incl. Green Eng.), and Sciences (Life, Physical and Health/Medical).**	Knowledge partners for basic and applied research (including other industry-specific services offered).
• **Departments (Law): Legal Services.**	Legal Services.
• **Division of Research Development**	Contract Management (Commercial Law)
• **Alumni**	Coaches, Mentors, Advisory Boards & Investors.
Innovus (Pty) Ltd:	Technology Transfer Services including:
• **Von Seidels & Other Partners**	Intellectual Property Protection services.
• **LaunchLab**	Office Space, Internship Programme, Corporate Identity, Mentors, Coaches & Business Developers, Entrepreneurship Courses.
External Partnerships:	
• **Thundafund**	Crowdfunding provides early adopters and marketing.
• **Product Development: XYZ, Skeg, Ithemba Labs, etc.**	Rapid prototyping and new product development.
• **Serendipity Group**	Cooperative Administration, legal support (investor incentives), accounting, telecommunication and fibre-optics, cooperative training.

The other key challenges and services that were identified above that are not supported by the general partnerships are accessing early adopters and customer acquisition, finding entrepreneurial teams and partner(s) and finding investors. These will need to organise separate knowledge network events such as a marketplace or flea market event, and CEO/investors are networking events. Through integrating knowledge networks into the enterprise innovation process, additional support services are provided as illustrated in the generic process in Figure 7.5 above.

7.5.4. ENTERPRISE FUNCTIONAL SYNTHESIS (OUTPUT)

The functional synthesis is the adapted organisation structure fit (refer to Figure 7.3 above) and enterprise innovation process (refer to Figure 7.5 above) to the specifics discussed for the SUCVCM. The benchmarking and standardised key performance indicators for the CVCM can also be applied for the SUCVCM.

7.6. CHAPTER SYNTHESIS

This chapter synthesis consists of the verification of framework with the respective objectives and design criteria that are defined in Chapter 6. The synthesis of the different framework components that meet the design criteria are listed Table 7.6 below, while through meeting the design criteria, the subsequent objectives relating to the group of design criteria are achieved and are further elaborated as follows.

> **[SFO: 1.0]** ***Develop a framework addressing problems in a given innovation ecosystem with an emphasis on innovation output.***

The **[SFO: 1.0]** objective is achieved in the purpose analysis aligning the purpose of the framework to focus on innovation output. It is also subsequently supported by the enterprise innovation process specifically addressing the gap analysis and focusing on the pre-seed to early states of business growth.

> **[SFO: 2.0]** ***Develop a flexible organisational structure supporting entrepreneurial teams.***
>
> **[SFO: 5.0]** ***Mitigate risk factors and implement success factors.***

The CVCM organisation structure allows entrepreneurial teams to be formed without giving away unnecessary business equity while the entrepreneurial team members can easily join and leave or be removed if there is a lack of contribution. The tax deduction benefits of cooperatives incentivise coaches, mentors, advisory boards and investors to get involved. Additionally, the CVCM provides other support benefits through general partnerships and cooperative administration mitigates risks, which will improve chances of successful implementation. For these reasons, the objectives **[SFO: 2.0]** and **[SFO: 5.0]** are achieved.

> **[SFO: 3.0]** ***Develop a complete innovation process supporting the important phases of the entrepreneurial development.***
>
> **[SFO: 4.0]** ***Supporting entrepreneurial teams throughout the innovation value chain.***
>
> **[SFO: 5.0]** ***Mitigate risk factors and implement success factors.***

The CVCM enterprise innovation process is fundamentally developed on supporting entrepreneurial teams from a financial roadmap perspective, as well as additional support services throughout the innovation value chain. This mitigates risks and supports entrepreneurial teams to stand a greater chance of succeeding. For these reasons, the objectives of **[SFO: 3.0]**, **[SFO: 4.0]** and **[SFO: 5.0]** are achieved.

> **[SFO: 6.0]** ***The framework should develop a specific cooperative venture capital model for the defined purpose.***

The CVCF is using a black box systems engineering approach in developing the specific CVCM according to the defined purpose analysis whereby the **[SFO: 6.0]** objective is achieved.

Table 7.6: Summary of the Framework Achieving the Required Design Criteria

Ref.	Design Criteria	Framework	Structural Component (s)	Output Significance & Motivation	Output Achieved
FDC: 1.1	***A framework focused on the innovation output and improved innovation efficiency.***	**CAPACITY AND GAP ANALYSIS (INPUT)**	Purpose Analysis & Capacity Analysis	In developing the CVCF, the purpose and emphasis are placed on supporting entrepreneurial teams through the innovation process from a late research to early investment states.	Yes
FDC: 1.3	***A framework is enabling the reduction in innovation capital gaps to support and further enable the innovation value chain.***		Gap Analysis & Support Services	The CVCM is fundamentally developed on the financial roadmap of start-up businesses considering funding gaps while a gap analysis on challenges and supporting services further supports the entrepreneurial teams in the innovation value chain.	Yes
FDC: 2.2	***The framework should mitigate numerous start-up business growth challenges, both internal and external.***		Capacity & Gap Analysis, & Support Services	The CVCM capacity and gap analysis identified crucial challenges and accounts to overcome these challenges with supporting services. Not all risks and challenges can necessarily be accounted for or overcome; the focus of the CVCM is on supporting entrepreneurial teams.	*Partially Yes*
FDC: 6.4	***The legal policy per country regarding cooperatives as a business entity needs to be considered in the structuring and financing of the cooperative.***		Purpose Analysis & Capacity Analysis	Each country's legislation is consulted in the purpose and capacity analysis in order to develop the CVCM.	Yes
FDC: 3.8	***Incentive structures and organisational culture need to be considered in the enterprise innovation process as well as the organisational structure fit.***	**ORGANISATION STRUCTURE FIT (BLACK BOX)**	Investors & Entrepreneurial Teams	For the investors, cooperatives provide more tax deductible incentives than other organisation structures. For entrepreneurial teams, the incentives are in the support to commercialise their ideas to create wealth. Researchers also benefit from greater financial gain incentives.	Yes
FDC: 4.2	***The necessary financial and intellectual capital structures are required to be incorporated into the framework.***		Financial support & Knowledge Networks	The CVCM is a financing service provider specifically focusing on commercialising innovative research while integrating knowledge networks to support its enterprise innovation process.	Yes
FDC: 5.3	***In the organisational structure, the venture capital model's fund management and risk mitigation properties are required in the developing the framework.***		CVCM: Investors & Management	The CVCM uses a similar organisation structuring to typical venture capital models and emphasises the portfolio effect to diversify the risks of investors.	Yes

Ref.	Design Criteria	Framework	Structural Component (s)	Output Significance & Motivation	Output Achieved
FDC: 5.4	***Best practice in venture capital is to be used as considerations in developing the framework*.**		CVCM: Investors	The CVCM uses a venture capital platform as the basis in the organisation structure while considering incubator and accelerator programmes in additional support to entrepreneurial teams.	Yes
FDC: 6.1	***The organisational structure fit of the framework is required to consider the different types of cooperative activities and models.***		CVCM: Organisation Structure	The CVCM essentially is a new generation, multipurpose cooperative that provides financing and support services to its members. For this purpose, different new generation cooperatives were considered from literature.	Yes
FDC: 6.2	***The organisational structure fit of the framework is required considered the level of the hierarchy in the cooperative model chosen.***		CVCM: Organisation Structure	The CVCM considers hierarchy levels with entrepreneurial teams forming primary cooperatives; management forming the secondary cooperative while regional/national tertiary cooperatives provides a scaling option.	Yes
FDC: 6.3	***The organisational structure and enterprise innovation process are required to mitigate risks through addressing the challenges faced with cooperative structures.***		CVCM: Organisation Structure	The CVCM addressed the challenges traditional cooperatives face in literature and paradigm in each specific country. While not all cooperative challenges can be successfully mitigated, the CVCM support services and structuring aims to address key challenges.	*Partially Yes*
FDC: 6.4	***The legal policy per country regarding cooperatives as a business entity needs to be considered in the structuring and financing of the cooperative.***		CVCM: Organisation Structure	The legislation and regulatory environment influences the implementation of the CVCM and is considered in the case study as a specific example of the application of the CVCM.	Yes
FDC: 6.5	***The role of entrepreneurship and enabling business development in cooperatives are to be considered in the development and structuring of the organisational structure of the framework.***		CVCM: Entrepreneurial Teams	The CVCM uses benefits of cooperatives and supporting services to enable and support the entrepreneurial teams in the innovation value chain.	Yes
FDC: 1.2	***A framework is supporting the innovation value chain and acting as a key enabler with its specific innovation process.***	**ENTERPRISE INNOVATION PROCESS (BLACK BOX)**	CVCM: Support Process	The CVCM aims to enable a pipeline of entrepreneurial teams through providing key support services throughout the innovation value chain.	*Partially Yes*
FDC: 2.1	***The enterprise innovation process of the framework should enable a hypothesis-driven entrepreneurial approach.***		CVCM: Entrepreneurial Teams	The CVCM enables and recommends entrepreneurial teams to apply the lean start-up methodology and supports the validated learning process.	Yes

Ref.	Design Criteria	Framework	Structural Component (s)	Output Significance & Motivation	Output Achieved
FDC: 2.3	***The enterprise innovation process should include entrepreneurial teams, not individuals and include management practices of the innovation process.***		CVCM: Entrepreneurial Teams	The CVCM enables entrepreneurial teams to form the primary cooperatives that are legally required to consist of five members.	Yes
FDC: 2.4	***The enterprise innovation process of the framework should fundamentally include the lean start-up methodology and the strategic fit model.***		CVCM: Innovation Process	In Chapter 4's literature review, the lean start-up methodology, strategic fit model and lean growth methodology are included in the CVCM innovation process as it best supports entrepreneurial teams. The business model canvas and experiment board is also included.	Yes
FDC: 2.5	***The enterprise innovation process of the framework should fundamentally include the growth states models.***		CVCM: Financial Roadmap & Innovation Process	In Chapter 4, the lean growth methodology was created based on the absorption capacity/tipped point growth states model. This lean growth methodology forms the basis for the innovation process supporting the entrepreneurial teams.	Yes
FDC: 3.1	***The enterprise innovation process fundamentally requires both a technological push and market pull.***		Purpose & Capacity Analysis	The enterprise innovation process requires two fundamental aspects, knowledge capital (technology) to 'push' or vehicle and human capital to 'pull' or drive the process of commercialisation. The CVCF analyses the purpose and capacity through testing the knowledge and human capital in order to develop the CVCM. Another aspect is the marketplace and early adopters provided as support services by the CVCM.	Yes
FDC: 3.2	***The enterprise innovation process requires the general processes to integrate components and functions.***		CVCM: Support Services, Financial Roadmap & Innovation Process	The CVCM integrates four main functions in the enterprise innovation process, namely, the CVCM management roles, support services, financial roadmap and innovation process. The CVCM management roles are strategic, information & knowledge, people & culture management, and organisation structure & processes. The other three aspects are integrated to provide essential support for the entrepreneurial teams.	Yes
FDC: 3.3	***The enterprise innovation process requires a good balance between inventing and commercialisation.***		CVCM: Support Services & Innovation Process	The entrepreneurial teams are formed after promising research is further developed into commercial value. This involves product/service development through building a business model supporting the commercial value proposition. Financing aspect further provides support and balance towards the inventing and commercialisation of technology.	Yes

Ref.	Design Criteria	Framework	Structural Component (s)	Output Significance & Motivation	Output Achieved
FDC: 3.4	***The enterprise innovation process requires to be designed for start-up businesses and dynamics of entrepreneurship, mitigating related risks.***		CVCM: Support Services, Financial Roadmap & Innovation Process	The support services and the financial roadmap helps mitigate risks and challenges entrepreneurial teams will face. Seeing that not all challenges can necessarily be supported and mitigated by the CVCM, it allows at least a dynamic approach through the innovation process for dynamic learning and growth for the entrepreneurial teams to make strategic decisions with.	*Partially Yes*
FDC: 3.5	***The enterprise innovation process must enable both incremental and disruptive innovation.***		CVCM: Innovation Process	The CVCM innovation process is not limited to a specific innovation type and can support all types, but is more limited to a specific purpose the CVCM is developed for. This purpose will identify specific fields and support services that can be limiting innovation types.	Yes
FDC: 3.6	***The enterprise innovation process requires 'gate-keepers' to enable the innovation process while specifically looking at taking innovation to market.***		CVCM: Innovation Process	The only 'gate-keepers' are the CVCM investing managers that enable financing for entrepreneurial teams to proceed with their innovation process. To limit the number of gates to ensure flexibility, investing managers will only invest at pre-seed and seed state while also having a role on the advisory board.	Yes
FDC: 3.7	***The enterprise innovation process requires taking into consideration the additional benefits provided by the type of organisation structure.***		CVCM: Organisation Structure	The CVCM draws strongly from the benefits gained by using the new generation, multipurpose cooperatives as a financing service provider (e.g. tax benefits for investors). They benefit also from the multipurpose cooperative as entrepreneurial teams do not have to give equity away for no value or co-founder producing no results risk. Essentially the venture capital organisation structure further supports the financing aspect of cooperatives to move new generation cooperatives towards financing serial entrepreneurship and innovation.	Yes
FDC: 4.1	***The management of the knowledge is essential to forming the basis of innovation and are required to be taken into consideration in the enterprise innovation process.***		CVCM: Information & Knowledge Management	The CVCM uses cooperative administration management software integrated with knowledge networks to support the essential knowledge management process. This also includes educational training in business and entrepreneurship as support services.	Yes

Ref.	Design Criteria	Framework	Structural Component (s)	Output Significance & Motivation	Output Achieved
FDC: 4.2	***The necessary financial and intellectual capital structures are required to be incorporated into the framework.***		CVCM: Innovation Process	The CVCM incorporates knowledge management support, as well as investment capital to entrepreneurial teams.	Yes
FDC: 4.3	***The enterprise innovation process requires the necessary information and knowledge flow provided by knowledge network models.***		CVCM: Information & Knowledge Management	The CVCM uses supporting information communication infrastructure and software to manage cooperative administration. It also uses integrated knowledge management to assist in the flow of information and knowledge.	Yes
FDC: 5.1	***The funding process of the venture capital model is required to be considered in the enterprise innovation process of the framework.***		CVCM: Financial Roadmap & Gap Analysis	The CVCM uses venture capital financing process and model to support the entrepreneurial teams through their innovation process. The CVCM specifically invests in growth gaps identified from the gap analysis which are entrepreneurial teams in pre-seed and seed states.	Yes
FDC: 5.2	***In the funding process of the venture capital model, an exit strategy is developed which is required for consideration in the enterprise innovation process of the framework.***		CVCM: Innovation Process & Financial Roadmap	The CVCM aims that entrepreneurial teams develop an exit strategy as part of their financial roadmap in the innovation process while the CVCM also benefits from teams receiving finance at later states (potential exits).	*Partially Yes*
FDC: 5.4	***Best practice in venture capital is to be used as consideration in developing the framework.***		CVCM: Organisation Structure & Innovation Process	The CVCM uses venture capital model processes in financing entrepreneurial teams and acts as an investment platform that was regarded as a movement in venture capital.	*Partially Yes*
FDC: 1.4	***A framework that enables elements of an entrepreneurial university and a shift towards an entrepreneurial university paradigm.***	**ENTERPRISE FUNCTIONAL SYNTHESIS (OUTPUT)**	CVCM: Innovation Process	The CVCM focus and purpose of research to gain its commercial value through supporting entrepreneurial teams is a definite movement for universities towards entrepreneurial universities.	Yes
FDC: 1.5	***A framework that improves the spin-off businesses that are created from intellectual property from public funded universities [in South Africa].***		CVCM: Innovation Process	The CVCM innovation process specifically seeks spin-off companies from university research to be supported through commercialisation.	Yes

8 Framework Verification and Validation Strategy

This chapter is where the research is verified and validated according to the research methodology. It includes the framework and case study being verified by the enterprise engineering structural components checklist and validated by interviews with industry experts.

8.1. INTRODUCTION

The purpose of this chapter is to describe the detailed process of the internal verification and external validation of this research study. The argument produced with the research methodology is discussed in relation to the specific components of the conceptual framework and example case study that was developed in Chapter 6 and illustrated in Chapter 7.

The objective of this chapter is aimed at internally verifying the development of the framework while external validation is executed with industry experts on the output produced by the framework. This chapter's layout is divided into three main components, namely, the research methodological argument, the framework verification and validation strategy, and the case study example and industry experts' strategy.

8.2. RESEARCH METHODOLOGICAL ARGUMENT

In Chapter 1, the research design methodology was designed and described based on the systems engineering approach developed (refer to Figure 1.2). Chapter 2 analysed and evaluated the literature and quantitative data available on South Africa's innovation ecosystem. This found the research study to be qualitative based with Chapter 2 defining the problem statement with limited supporting empirical data.

In Chapters 3 to 6, the core focus based on innovation and entrepreneurship evaluated the relating literature in the pursuit of best practice solutions, models and tools in solving the identified problem in Chapter 2. Each of these chapters had specific sub-research questions, which were answered in the literature review. An enterprise engineering methodology was selected to develop the CVCF to integrate the various solutions into a whole solution.

As this research study is qualitative based, the empirical data collected from interviews with industry experts are of a qualitative nature focusing on externally validating the framework, as the nature of the information and knowledge is ontologically and epistemologically based. In evaluating the best practice models from the literature, a deductive reasoning approach was formed with the specific focus on the general information in the field that was systematically focused on specific information.

In developing the framework, an inductive reasoning approach was used in evaluating the specific models and information from the literature to produce a general framework. Notably the framework is a generic framework that is developed to produce specific models as output. The inductive reasoning is aimed at selecting the best practice models from the literature and applies the constructivism theory as fundamental to the research methodology in order to produce the generic framework.

The constructivism theory[124] is an epistemologically based theory and simply argues that human beings generate understanding and knowledge from interacting between their existing experience and knowledge, as well as

[124] *Jean Piaget, founder of constructivism in 1967.*

their ideas. According to Eddy (2004), the constructivism theory has influenced a range of disciplines, which includes fields such as education, psychology, sociology, and even the history of science. Guba & Lincoln (1994) extensively argue the fusion between ontology and epistemology, and the role of constructivism. In their cross paradigm analysis, the following relationships and concepts were determined (Guba & Lincoln, 1994, p. 111):

- **Ontology and Constructivism:** *"[The] relativism assumes that multiple, apprehendable and conflicting social realities that are the products of human intellects, but that may change, as their constructors, become more informed and sophisticated."*
- **Epistemology and Constructivism:** "*Somewhat similar, but broader transactional/subjectivist assumption that sees knowledge as created in interaction among investigator and respondents.*"

The abstract nature of the conceptual framework using an enterprise engineering methodology can be argued to be based on the constructivism theory as a fusion between ontology and epistemology. This is illustrated and discussed in Chapter 6 (refer to Figure 6.9) where the enterprise engineering methodology is described. The essence of this research study is that developed enterprise engineering methodology can be applied in developing a conceptual framework. From an ontological perspective, value is mediated from the findings created while from an epistemological perspective the findings literally created value. However, the essence remains in measuring this research inquiry.

This is because the research inquiry is aimed at developing an understanding and reconstruction of knowledge with the nature of the knowledge focused on individual reconstructions amalgamating around agreement (Guba & Lincoln, 1994). The quality criteria for the constructivism theory is defined as follows:

- **Trustworthiness:** Moral value regarded as value. In other words, is the research trustworthy with the validation being credible and can it be depended on? There is also an aspect of transferability whereby the research judges the ease of knowledge transfer and reproduction.
- **Authenticity:** Quality of being authentic. In other words, is the research authentic and educative in contributing towards a new paradigm?
- **Misapprehensions:** Refers to the misguided belief about or interpretation of something. In other words there is a new paradigm formed.

The constructivism theory essentially requires that a new paradigm is created from the research study, and the quality is measured in terms of trustworthiness, authenticity and misapprehensions. The hegemony of the constructivism theory is aimed at seeking recognition and input which in this research study is achieved through interviews with industry experts. The argument formed based on the constructivism theory, ultimately seeks internal verification from the framework design criteria and enterprise engineering methodology, and the external validation from industry experts. The input received is aimed at supporting further development of the framework and is seen as a recommendation.

8.3. FRAMEWORK VERIFICATION AND VALIDATION STRATEGY

The framework verification and validation strategy consists of internal verification and external validation that aims to indicate the trustworthiness and authenticity of the research, while confirming any misapprehensions.

8.3.1. INTERNAL VERIFICATION

The internal verification is mainly comprised of two aspects and is illustrated in the framework development methodology in Chapter 6 (refer to Figure 6.9). Firstly, the framework is developed based on the constructivism theory whereby best practices from the literature were used to develop the design criteria of the framework. Secondly, an enterprise engineering methodology was developed from the literature that was used as a structural components checklist to verify the developed framework.

8.3.1.1. FRAMEWORK DESIGN CRITERIA

The framework is developed using objectives and design criteria that were founded out of the literature review. The objectives of the framework are summarised in Table 6.1, while the design criteria from the literature review are summarised throughout Chapter 6. The set of objectives that the framework achieved is verified in section 7.7 of Chapter 7, while the framework's design criteria met are extensively discussed in Table 7.6.

The establishment of the design criteria from the literature review aligns with the underlying concept of the constructivism theory whereby understanding is generated through combining knowledge, experience and ideas to develop the design criteria. The design criteria were then used to develop a framework to create a new paradigm. However, what is the quality of the new paradigm created using the design criteria?

The design criteria provide the trustworthiness from the extensive and reliable sources used in the literature review while the authenticity is achieved through combining different fields of concern creating a new paradigm and misapprehensions of the research application. However, this on its own is limited in verifying establishing the required structural components and the quality of the new paradigm created.

8.3.1.2. ENTERPRISE ENGINEERING METHODOLOGY

The enterprise engineering methodology is based on the enterprise engineering classification system (refer to Figure 6.8) by Dietz, *et al.* (2013) which the structural components of the framework are required to comply with. This enterprise engineering methodology is extensively described in Chapter 6, and the structural components are synthesised in Table 6.9.

The enterprise engineering methodology is used as an overarching high-level requirement for the development of the framework (refer to Figure 6.2) and consists of six structural components that effectively measure the framework to have applied an enterprise engineering approach. Therefore, the enterprise engineering methodology essentially acts as a development tool to measure the output using the structural components as a checklist.

The structural components applied in the CVCF are synthesised in Table 8.1, where the different structural components of the framework (output) are described in relation to the enterprise engineering structural components and whether the output achieved is verified accordingly. This ensures that the framework developed is aligned with the underlining concepts and principles defined by the enterprise engineering methodology.

The purpose for the enterprise engineering methodology is essentially to ensure reliability in the framework application and design. This also adds an extra level of trustworthiness of the research produced, but the enterprise engineering methodology is limited due to the lack of literature available in the field of enterprise engineering.

The add value for using the enterprise engineering methodology is that it further authenticates the developed framework and produces a new approach and paradigm in the application of enterprise engineering. However, there remain plenty of misconceptions in the field of enterprise engineering and future research of further developing enterprise engineering structural components can benefit this promising field of research.

Table 8.1: The Enterprise Engineering Structural Components Applied and Verified in the CVCF

Ref.	Enterprise Engineering Structural Components	Framework	Framework Output Motivation	Output Verified
EESC: 1.0	**Enterprise Processes and Systems**	Management & Executives	*The role and responsibilities of the CVCM management and executives[125] is to establish the alignment between the organisation structure and the formal internal processes and systems in order to provide the support structures to enable the entrepreneurial teams in the innovation process. This essentially includes establishing the investment fund, establishing general partnerships with support services, and establishing a pipeline of entrepreneurial teams.*	**Yes**
EESC: 1.0	**Enterprise Processes and Systems**	Cooperative Administration	*A key general partnership with specialist cooperative administrators is essential for managing the administration, coordination and other cooperative related services. This becomes especially challenging with large-scale cooperatives which require specialist software and IT support systems and processes.*	**Yes**
EESC: 1.0	**Enterprise Processes and Systems**	Information & Knowledge Management	*A strong IT back-end support system is required to not only support the cooperative administration in managing the entrepreneurial teams, but also provide information and knowledge flow between respective members. It also enables additional support services that can be offered to entrepreneurial teams.*	**Yes**
EESC: 1.0	**Enterprise Processes and Systems**	Innovation Process & Support Services	*The CVCM uses the best practice innovation, and strategic models from the literature to support entrepreneurial teams, combined with the necessary support services as formal processes and systems that will enable entrepreneurial growth.*	**Yes**
EESC: 2.0	**Human Resource Management and Incentives**	People and Culture Management	*The CVCM management and executives are responsible for managing the general and strategic partnerships, as well as aligning the entrepreneurial teams with access to the support services. This people management is essential and establishing a specific culture at the CVCM with the specific set values; beliefs and vision is required to ensure continuity within the CVCM.*	**Yes**
EESC: 2.0	**Human Resource Management and Incentives**	Investors Incentives & Funding	*The CVCM essentially needs to incentivise the investors (including alumni) to invest into the CVCM investment fund through competitively providing tax deductions and return on investment. The fund also includes other investors such as tax levies and public support which requires different incentivising such as poverty alleviation, employment generation, etc. which needs to be guaranteed.*	**Yes**
EESC: 2.0	**Human Resource Management and Incentives**	Entrepreneurial Teams Incentives	*The CVCM essentially also needs to incentivise entrepreneurial teams to join the CVCM organisation through providing unique supporting services and investment to entrepreneurial teams to grow their businesses.*	**Yes**

[125] *Note that the CVCM management and executives have four distinct high-level functions that includes strategic management, information and knowledge management, organisation structure and processes, and people and culture management.*

Ref.	Enterprise Engineering Structural Components	Framework	Framework Output Motivation	Output Verified
EESC: 3.0	**Information and Knowledge Management Processes**	Cooperative Administration	*The CVCM uses the cooperative administration and coordination software to manage critical information and knowledge flow between cooperatives.*	**Yes**
		Information & Knowledge Management	*The CVCM information and knowledge management is also used to promote and manage other important information of support services (e.g. accounting, legal and marketing) while education-training programmes support knowledge creation.*	
		Integrated Knowledge Networks	*The CVCM also uses integrated knowledge networks to promote and manage knowledge creation and transfer through leveraging managers and executives' networks to support entrepreneurial teams.*	
EESC: 4.0	**Organisational Structure**	Venture Capital	*The CVCM uses a venture capital organisation structure by replacing the company legal entities with cooperative legal entities. An investment fund invests in primary cooperatives that are represented by the secondary cooperative. The venture capital model is uniquely designed to form part of the CVCF and is essentially engineered to be a venture capital platform supporting entrepreneurial teams.*	**Yes**
		Cooperatives	*The CVCM organisation structure has a secondary cooperative forming the portfolio management vehicle, multiple primary cooperatives acting as a vehicle for entrepreneurial teams, and a tertiary cooperative for scaling to regional or national level. All cooperatives are multiple purpose, while secondary cooperatives specialise in financial services. This is possible with new generation cooperatives becoming more flexible and hybrids.*	
EESC: 5.0	**Strategic Initiatives Management**	Cooperative Hierarchy	*The strategic options to scale the CVCM to regional and national tertiary cooperatives serves the purpose and interests in implementing multiple secondary portfolio cooperatives.*	**Yes**
		Entrepreneurial Teams	*The CVCM supports entrepreneurial teams to use hybrid cooperatives that provide them with multiple strategic options (e.g. not give equity away early) and most essentially to take the idea to market with speed. Primary cooperatives also provide flexibility in measuring output and registering/deregistering with limited cost of doing business.*	
		Strategic and General Partnerships	*The CVCM also allows for strategic partnerships to be established, especially in the case for scaling to regional or national level, while general partnerships are key in providing the necessary support services. The CVCM organisation structure provides flexibility to ensure multiple strategic options.*	
EESC: 6.0	**Overall Integration of Complex Systems and Structures**	Organisation Structure & Enterprise Innovation Process	*The CVCM integrates each of the above-mentioned structural components in its organisation structure to provide a value proposition to all stakeholders involved with its enterprise innovation process. The CVCM enterprise innovation process also fundamentally integrates the CVCM management, financial roadmaps, support services and innovation processes of entrepreneurial teams.*	**Yes**

8.3.2. EXTERNAL VALIDATION

The use of external validation provides further credibility and trustworthiness to the research study. This is to emphasise the authenticity of the research by considering the opinions and recommendations from industry experts. The framework used a case study of Stellenbosch University ecosystem to illustrate the application of the framework in order to form a basis for interviewees to relate too.

The external validation consists of interviews with industry experts on two different components related to this research study. The first component uses structured interviews with innovators, entrepreneurs and business developers that are used to gather information on their challenges, risks and requirements to grow their start-up or spin-off business. This information gained is also compared with the findings from the literature to align specifics that were missed in the literature.

The second component uses semi-structured interviews with business developers, managers and executives in the Stellenbosch University ecosystem to evaluate the framework and case study to provide critique and recommendations. This is aimed to provide trustworthiness specifically further in the developed framework and the application thereof, as well as highlight any misapprehensions.

8.3.2.1. INNOVATORS, ENTREPRENEURS AND BUSINESS DEVELOPERS

The structured interviews with innovators, entrepreneurs and business developers were used to validate specific findings from the literature and the purpose for developing the CVCF. These structured interviews were used in the case study of Stellenbosch University ecosystem and were limited to innovators, entrepreneurs and business developers within the Stellenbosch University ecosystem.

In total there were thirteen structured interviews conducted with innovators, entrepreneurs and business developers that are in the ten different start-up or spin-off businesses. These businesses related to the Stellenbosch University ecosystem either form part of the LaunchLab (business incubator) or Innovus (Pty) Ltd (technology transfer office). The findings of the structured interviews with innovators, entrepreneurs and business developers are discussed in Chapter 7 (refer to section 7.5) and the dataset of the interviews is in Appendix C.1.

The interviews involved three sets of questions, namely, background information, challenges and gap analysis, and perspectives and recommendation analysis. The background information simply involved the details of the start-up or spin-off business the entrepreneur, innovator or business developer was in; its relation to the Stellenbosch University; and what stage or state the start-up or spin-off business was at. The stages/states were identified to be research/ideation, pre-seed, seed, early and later, while interviewees could classify other stages/states if they considered themselves not within the mentioned stages/states.

The challenges and gap analysis involved the following questions:

- What are the main challenges as an entrepreneur, innovator, or start-up or spin-off business? Also, which three challenges provide the biggest risk to you?
- What sources of financing are you currently using? What is the next round of investment you are seeking?

The perspectives and recommendations analysis involved the following questions:

- In South Africa's start-up ecosystem, are there any major growth gaps (valleys of death) due to lack of support?
- In a business incubator, which of the following support services would you require? In addition, which three support services are the most important to you?
- What is your perspective on cooperatives as legal entities? Would you consider joining an entrepreneurial team in a cooperative?

8.3.2.2. BUSINESS DEVELOPERS, MANAGERS AND EXECUTIVES

The purpose of the semi-structured interviews was specifically to evaluate the framework, the application of the framework as a case study and to provide appraisals, critique and recommendations on the framework. The interviews are limited in that the CVCF requires expertise from multiple domains due to its unique compilation of attributes. For example, not all business developers, entrepreneurs and innovators have worked with managing investment funds or used cooperative legal entities.

Therefore, the target interviewees were business developers, managers and executives specialising in the field of entrepreneurship and innovation, while a specific Stellenbosch University Cooperative Venture Capital Model (SUCVCM) was developed as a case study to illustrate the application of the CVCF. The semi-structured interviews were conducted with five business developers, managers and executives of the Launchlab and Innovus (Pty) Ltd. that were selected for their specific role and expertise in supporting Stellenbosch University entrepreneurs and for commercialising intellectual property produced by the University.

The interviews followed a systematic approach in describing the CVCF and SUCVCM using a presentation format that is followed by seeking appraisals, critique and recommendations on key components of the CVCF. All the interviews were also recorded for documentation purposes to allow a more flexible interview to achieve valuable recommendations. The presentation for the interview consisted of the core components CVCF and relevant information of how it was applied in the SUCVCM, while the details of the five interviewees and their relation to the Stellenbosch University ecosystem are listed in Table 8.2 below.

Table 8.2: Details of Interviewees in the Semi-Structured Interviews with Business Developers, Management & Executives

Interviewee	Company	Position	University Relation
Dr Charles Marais	Innovus (Pty) Ltd	Business Developer	Technology Transfer: Spin-off Companies
Christle De Beer	Innovus (Pty) Ltd	Technology Transfer Officer	Technology Transfer: Licencing
Johnathan Smit	Innovus (Pty) Ltd	Innovation Officer	Business Incubator & Technology Transfer
Philip Marais	LaunchLab	CEO	Business Incubator
JD Labuschange	LaunchLab	Junior Business Developer	Business Incubator

The process that the semi-structured interviews followed was based on presenting the CVCF and SUCVCM, which was followed by discussions on the following aspects:

- **Input Analysis:**
    - Purpose Analysis: Promoting an alternative solution to supporting an entrepreneurial university and commercialising university intellectual property.
    - Capacity Analysis: Analysing the knowledge and human capital to determine the capacity for the application of the CVCM.
    - Gap Analysis: The challenges and valleys of death entrepreneurs are facing as well as gaps universities face at commercialising intellectual property.
- **Organisation Structure Fit:**
    - The CVCM basic organisation structure and cooperative hierarchy levels.
    - The role of outsourcing the cooperative administration to specialists in the field.
    - The role of establishing general partnerships for the CVCM and any particular general partnerships that they can identify for the SUCVCM.
    - The role of establishing strategic partnerships for the CVCM and any particular strategic partnerships that they can identify for the SUCVCM.
    - The role of collaborative projects for the CVCM and any particular collaborative projects that they can identify for the SUCVCM.
    - The establishing of the venture capital fund and considering investors, alumni, public support, industry sponsorships, corporate social investment and tax levies.
- **Enterprise Innovation Process:**
    - Financial roadmap associated with the start-up businesses in terms of cashflow, net income and revenue. It also includes the investment states that can be generally expected in the financial roadmap of a start-up business.
    - Supporting services and knowledge networks associated to overcoming challenges and reducing costs of doing business for the entrepreneurial teams.
    - CVCM management and executives associated roles and responsibilities.
    - The entrepreneurial teams form primary cooperatives and are formed using term sheet agreements to avoid giving away equity when no value is created while focusing on team

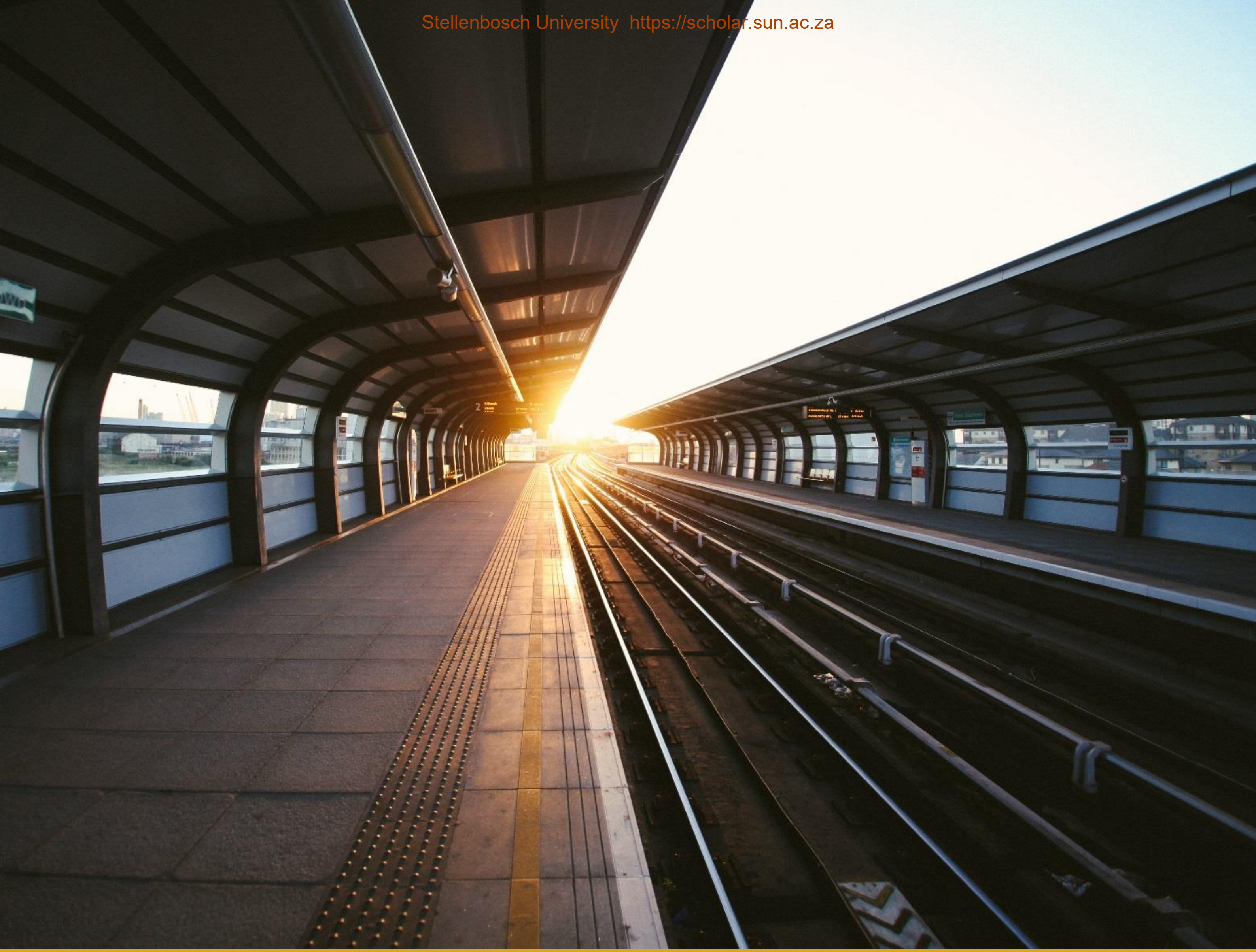
members contributing output value. The flexibility of this primary cooperative structure is also discussed as deregistration and shadow cooperatives implement in cases of failure.

  - The innovation process specifically involving the models and tools found in literature, specifically the developed lean growth methodology and its application as a model for entrepreneurial teams. This is based on the growth states model whereby funding and the financial roadmap are associated to states and stage growths.

- **Enterprise Functional Output:**
  - Benchmarking the CVCM and any associated models such as the SUCVCM.
  - Measuring success and establishing key performance indicators.

The review of the semi-structured interviews is synthesised and the following noteworthy comments and recommendations concerning the CVCF, Stellenbosch University ecosystem and the SUCVCM are mentioned below:

- Not all knowledge capital or intellectual property has a commercial value because research funding is 'too early stage' producing non-commercial value intellectual property. Therefore, there are 'slim pickings'.
- The government of South Africa's incentive structure for university researchers is to produce publications, rather than generate intellectual property with commercial value. It is regarded as a top management paradigm requiring a shift towards a more entrepreneurial university.
- The role of Innovus (Pty) Ltd is not research management, but technology transfer while intellectual property protection services are outsourced to legal practitioners. They are understaffed and have limited time to develop comprehensive intellectual property protection strategies and market research.
- The LaunchLab aims to scale and become the regional business incubator for the universities in the Western Cape. This provides shared services across the region and will give start-up businesses more visibility to investors.
- The South African venture capital ecosystem is very immature with limited access to raising capital for investment funds (lack of foreign direct investment), while start-up business are also limited in obtaining financing.
- The LaunchLab and Innovus (Pty) Ltd identified the problem with start-up or spin-off businesses as initial equity structuring, where equity is given away too early.



9 Framework Feedback and Adjustment

This chapter uses the feedback received from the validation strategy to adjust the framework. It includes the recommendations from industry experts on the developed framework and adjusts it accordingly to incorporate their recommendations.

9.1. INTRODUCTION

The purpose of this chapter is to describe the adjustments to the conceptual framework that was identified from the feedback received. In Chapter 8, the general comments and recommendations were discussed as well as the semi-structured interviews with business developers, managers and executives at the LaunchLab and Innovus (Pty) Ltd. The feedback received is divided into appraisals, critique and recommendations whereby adjustments are identified further to improve the conceptual framework and case study.

9.2. FRAMEWORK RECOMMENDATIONS

The review of the semi-structured interviews is synthesised into three main aspects, namely, appraisals, critique and recommendations or suggestions. In Chapter 8, the outline of the semi-structured questions of the interviews is listed and the details of the interviewees are listed in Table 8.2.

The appraisals from the interviews on the CVCF and SUCVCM include the following:

- In all the interviews, the CVCF was agreed to be comprehensive and inclusive in the organisation structure and enterprise innovation processes, as well as a thorough and diligent thought process throughout the development of CVCM or SUCVCM.
- The lean growth methodology and the enterprise innovation process of the CVCF is regarded as sufficient in supporting entrepreneurial teams, while there is also general acceptance of the growth states identified for the CVCF.

The critique aspects of the CVCF and SUCVCM included the following:

- The main critique is the misapprehension of what cooperatives are and especially the capabilities of the new generation cooperatives ownership rights. However, this is limited with the paradigm of traditional cooperatives and their disadvantages. This then leads to the notion between whether an ordinary company or a cooperative is more beneficial to establish.
- Another critique regarding traditional cooperatives is the lack of flexibility in exiting and reducing or removing of assets (liquidation). This leads to the notion on whether primary cooperatives can exit? There is also lack of understanding initially on the benefits that cooperative incentives provide to entrepreneurial teams and investors.
- The role of industry sponsorship is very important to the LaunchLab and associated business incubators, which is neglected in the development of CVCF. Industry sponsorship plays a vital role as part of philanthropy in supporting the development of a region or country.
- Another critique is the benchmarking and performance measuring of entrepreneurial teams that requires a clear definition of success, but must also measure the health performance of the start-up business as well as the mental health of the entrepreneur. The CVCF did not consider in-depth performance benchmarks as mentioned.

- The role of coaches, mentors and advisory board in incentivising them to provide services, expertise and time, generally a tax certificate is given in exchange for their time and expertise. This was not considered in the development of the CVCF.
- The role of technology transfer in terms of licensing or selling the technology or intellectual property to industry was not explained in the development and application of the CVCF. However, with the flexibility in the new generation cooperatives, the primary cooperatives are hybrid and can be converted into a licensing structure once commercial viability has been shown.

The recommendations or suggestions on improving the CVCF and SUCVCM included the following:

- The LaunchLab provides an internship programme whereby Stellenbosch University students are employed by the start-up businesses through the support of funding from the LaucnhLab which is available for paying the internships for a limited period (Labuschange, 2014). The start-up businesses can then consider employing the students on a longer-term basis after the completion of the internship programme.
- Benchmarking of technology transfer offices does not have benchmarks for spin-off businesses, but Association of University Technology Managers[126] (AUTM) provides global metrics and data on technology transfer activity. The important aspects to consider in measuring the performance of technology transfer is to consider the entire family of the intellectual property protection strategy ('*patent family*'). Other key performance indicators of knowledge capital is the number of licensing or sales to industry and the revenue generated. Another aspect is measuring the impact the technology or intellectual property will have on the community, region or country. (De Beer, 2014)
- The CVCF is not the '*golden solution*' from a national perspective as government legislation and numerous other external factors play a role in improving the entrepreneurial ecosystem of a region and country (Smit, 2014).
- The tax deductions and implications in South Africa for cooperatives with regards to capital gains tax and venture capital companies (Section J12) are to be considered for future research (Smit, 2014; Marais, 2014a). Especially concerning incentivising investors and entrepreneurial teams to establish cooperatives over other ordinary companies.

The above-mentioned feedback from the interviews with industry experts does not all provide feedback that could positively contribute towards the framework and therefore, will not be considered for adjusting the framework. In some of the cases of recommendations or suggestions, the framework already provides a similar solution, which means that the particular feedback can be neglected.

[126] *For more information on technology transfer metrics and data from* AUTM, 2014. Metrics and Data. [Online] Available at http://www.autm.net/Metrics_and_Data.htm [Accessed 20 November 2014].

9.3. FRAMEWORK ADJUSTMENTS

The framework adjustments from the feedback discussed above, are not all identified as crucial or necessarily beneficial to the CVCF. The majority of the critique came from misapprehensions on cooperatives and requires a paradigm shift in the application of cooperatives. The two identified adjustments to the framework include the strategic positioning of the CVCF and metrics that will improve the case study of Stellenbosch University ecosystem.

9.1.1. STRATEGIC POSITIONING COMPONENT

The external environment has a major impact on the strategic positioning of the CVCM and is required to be taken into consideration in the designing of the CVCM produced by the CVCF. The strategic positioning comes from the suggestion by Smit (2014) and is stated as follows:

> *The CVCF is not the 'golden solution' from a national perspective as government legislation and numerous other external factors play a role in improving the entrepreneurial ecosystem of a region and country (Smit, 2014).*

The role of the CVCF is to strategically position itself within the quadro-helix model of the entrepreneurial ecosystem. Building on to this suggestion, the CVCF considers the work by Isenberg (2012) and Vogel (2013) which was discussed in Chapter 2 (refer to Figure 2.16 and Table 2.4). The strategic positioning component is illustrated in Figure 9.1 below, considers the external positioning of the CVCM to best enable entrepreneurship and innovation in a given environment.

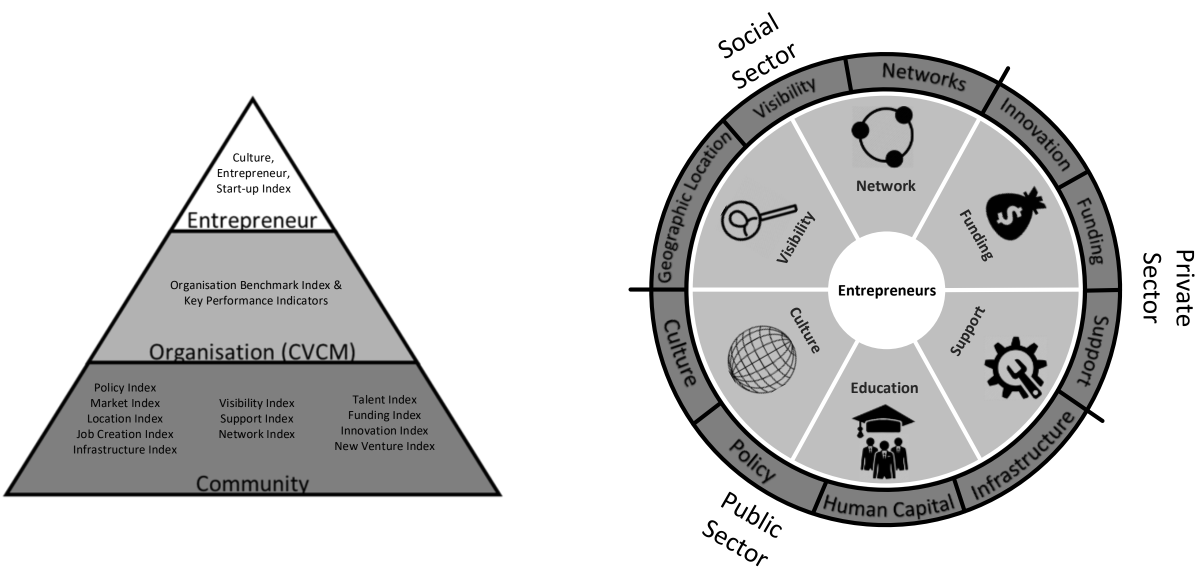


Figure 9.1: CVCF Strategic Positioning Component (Input Analysis) adapted from Isenberg (2012) and Vogel (2013)

The strategic positioning component is divided into three categories, namely, community (external), organisation (CVCM strategic positioning) and entrepreneurs (internal). Figure 9.1 illustrates conceptually the alignment and in Table 2.4 the different components and categories are listed.

9.1.2. STELLENBOSCH UNIVERSITY COOPERATIVE VENTURE CAPITAL MODEL

The three recommendations, suggestions and critique that are relevant to adapting the SUCVCM or require additional explanation in application include the following:

- Performance measuring and benchmarking of entrepreneurial teams, individuals and the CVCM.
- Incentivising of coaches, mentors and advisory board to provide services, expertise and time, as well as the incentives to entrepreneurial teams, investors and industry sponsorships.
- The flexibility of cooperatives as a vehicle to license or sell the technology or intellectual property to industry, as well as implementing other exit strategies.

In Figure 9.2 below, the SUCVCM organisation structure is illustrated as developed in Chapter 7 and key aspects are emphasised as follows from the feedback received:

- The cooperative legislation in South Africa does not fully support the notion of new generation cooperatives at a primary cooperative hierarchy level. This requires strictly that five or more members form the primary cooperative, but with a term sheet agreement of leadership roles, output and responsibilities and initial equity (including CVCM liquation preference equity for seed funding). Once commercial value has been established, the entrepreneurial team members' contributions are determined based on their performances. The primary cooperative is a hybrid which means it can then be converted as part of its exit strategy into another legal entity such as an ordinary company, joint venture or even a licensing structure.
- The general incentives of the CVCM for entrepreneurial teams are funding and support services, while investors receive investment opportunities of high-potential start-up businesses. Industry sponsorships invest with tax benefits such as corporate social investment. Coaches, mentors and advisory boards are incentivised to join as members of the primary cooperatives and are awarded for contributions financially, but tax certificates are also an option to consider for coaches, mentors and advisory board members that are limited in time to contribute.
- The performance measuring of the CVCM is also aligned with the strategic positioning component (refer to Figure 9.1). The performance measuring of the external environment is essential to continuously strategically position the CVCM to provide the optimal support to its entrepreneurs which community indexes can provide sufficient information. The performance of the entrepreneurial teams is also important and the advisory boards and management assigned will specifically play a role of measuring progress. Then individual entrepreneur's health is also important as it directly relates to the performance of the start-up business whereby the mentors and organisational culture will support individual health checks.

The SUCVCM illustrated in Figure 9.2 specifically considers three themed departments in the CVCM, namely, Science and Technology, E-commerce and Technology, and Social Development. Each of these departments will have specific support services such as coaches, mentors and advisory boards, and professional services that will support the development of the entrepreneurial teams. The role of the general partnerships and cooperative administration is also illustrated in providing support services as well as collaborative projects (e.g. internship programme). The CVCM organisation structure is also based on the basic cooperative venture capital structure with the potential of scaling to a regional tertiary cooperative with multiple secondary portfolio cooperatives as the LaunchLab has envisaged.

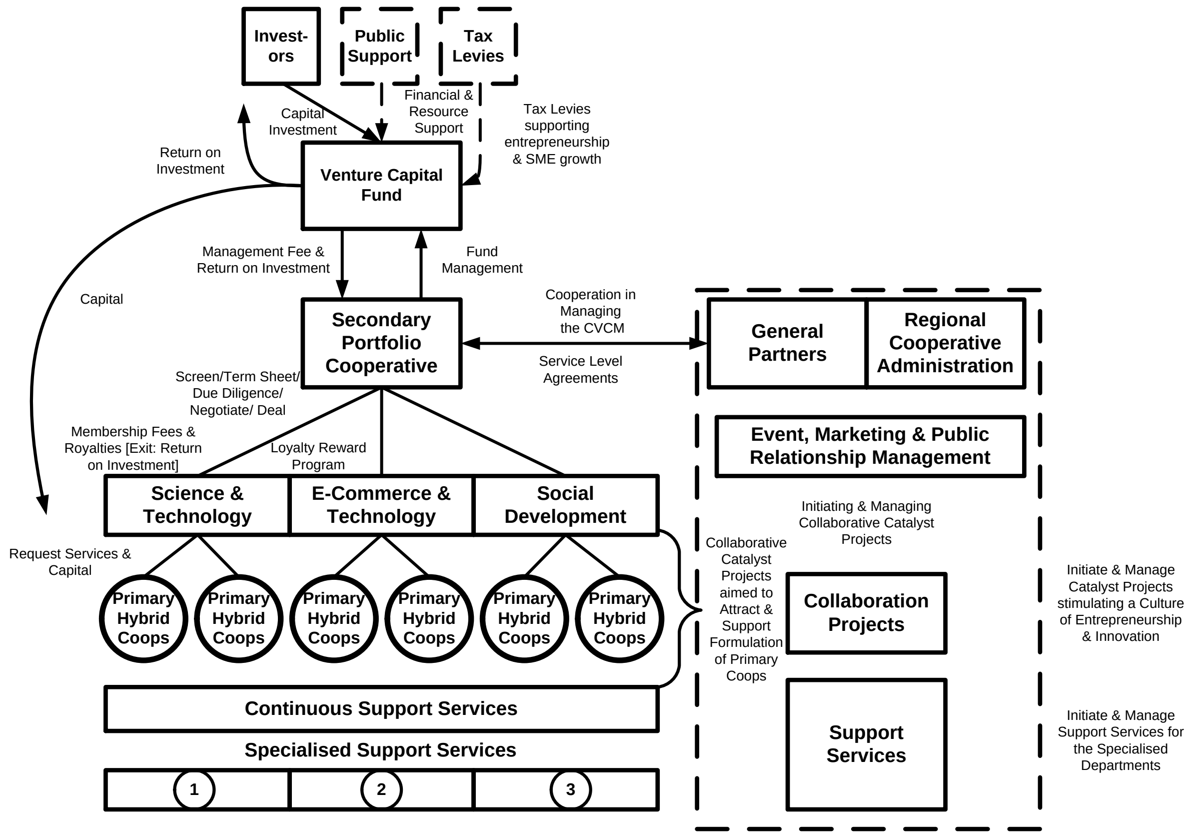


Figure 9.2: Adjustment to the SUCVCM Based on Feedback

10 Research Conclusion and Recommendations

This chapter provides the final outcomes, conclusions and recommendations found in the process of this research methodology. It also provides the significance and future research opportunities of this research study.

10.1. INTRODUCTION

The objective of this chapter is **[SRO:10.0]** ***confirm the alignment between the research methodology and the concluding findings, as well as provide the necessary significance and recommendations for future research,*** as described in Chapter 1 and illustrated in Figure 1.2.

The high-level overview of this chapter structure outline is illustrated in Figure 10.1 and addresses the following:

- **Research Methodology Alignment:** An analysis on the research methodology is used with a cross reference between the components of the research methodology and the document chapters, as well as the alignment between the research methodology and the framework methodology.
- **Novelty and Significance:** A synthesis of the significance of the different embedded components in this research and novelty produced by the research.
- **Future Research Opportunities:** A discussion on the different future research opportunities identified and derived from this research.
- **Final Concluding Remarks:** The research conclusions are based on the outcome of the research methodology and the developed conceptual framework, as well as the analysis done on the framework and case study in Chapter 8.

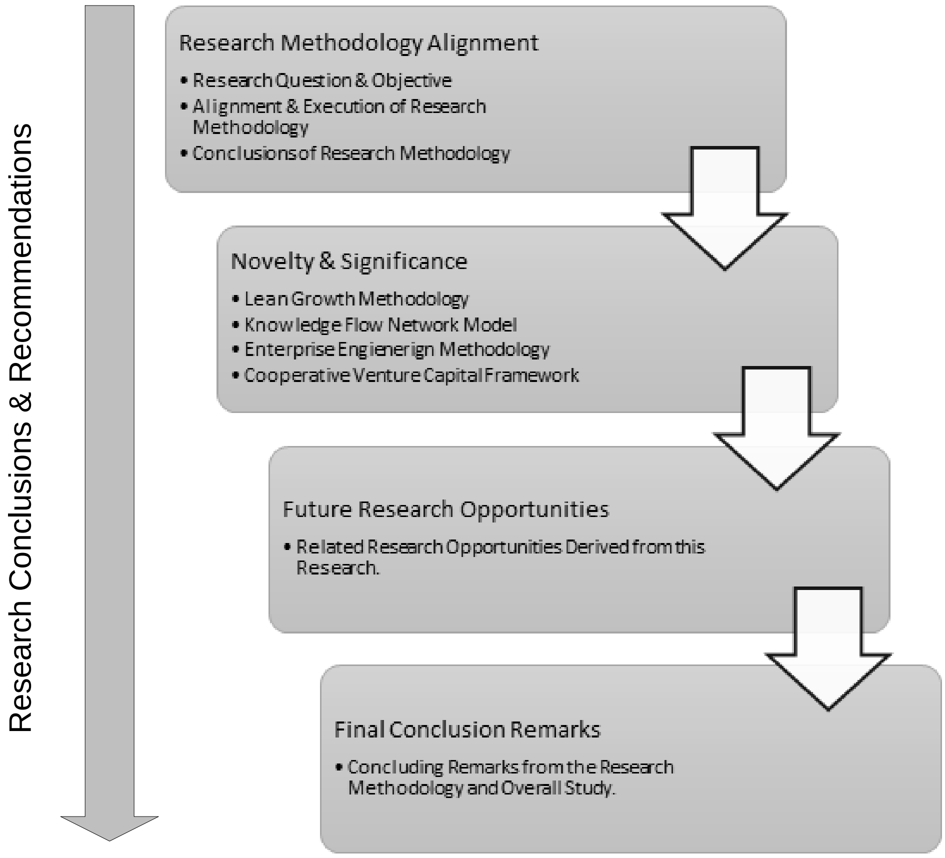


Figure 10.1: The Structure of Chapter 10

10.2. RESEARCH METHODOLOGY ALIGNMENT

As discussed in section 1.4.3 of Chapter 1, the Main Research Question [MRQ] for this study is:

[MRQ]: ***What alternative solution can be developed that will support and promote an entrepreneurial and innovation pipeline that specifically focuses on the value chain of commercialisation?***

Following the systems engineering approach illustrated in Figure 1.2, the MRQ was formulated from the complex problem defined in the preliminary literature review and was disseminated into sub-research questions. The importance is to align the complex problem with the main research objective [MRO] that is as follows:

[MRO]: ***Develop an alternative solution that will support and promote an entrepreneurship and innovation pipeline that will specifically focus on the value stream of commercialisation.***

This section demonstrates how the MRQ has been addressed in this research, but first discusses the execution and alignment of the research methodology, and then explains in the conclusion how the research problem has been addressed.

10.2.1. ALIGNMENT AND EXECUTION OF THE RESEARCH METHODOLOGY

In order to adequately address the MRQ, the understanding of the research methodology and how the various research components are aligned within the context of the research methodology is required. The research methodology is based on the constructivism theory whereby knowledge accumulation and reconstruction is used to create new knowledge, and uses a systems engineering approach to guide the research process (refer to Figure 1.2).

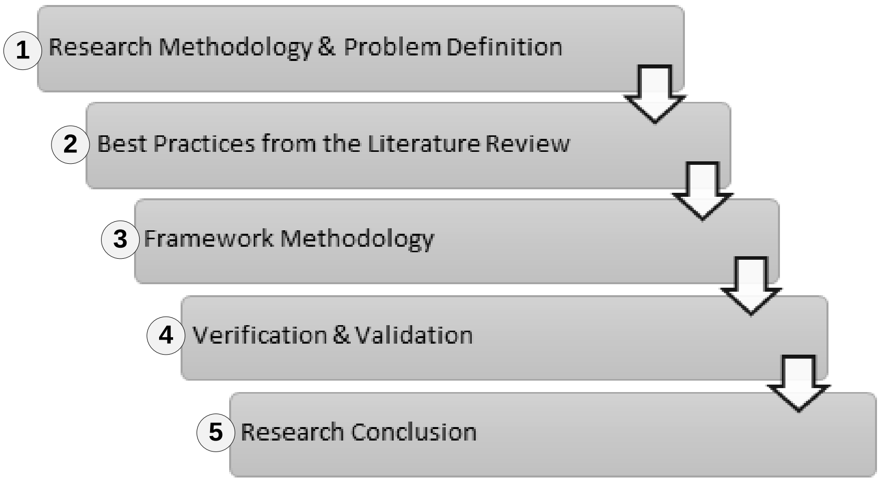


Figure 10.2: The Research Methodology Alignment and Execution Process

The process of aligning and executing the research methodology is illustrated in Figure 10.2 above, while the alignment and execution of the research methodology process is synthesised within the context of the systems engineering approach as illustrated in Figure 10.3 below. The research methodology allowed for the dissemination of the complex problem into respective fields of concern and their unit problems whereby an extensive literature review identified potential unit solutions. The unit solution is then converted into the design criteria which forms part of the framework methodology. The alignment of the MRQ and the Main Framework Objective [MFO] allows for the conceptual framework to be used as a solution to the complex problem. The '*whole solution*' is then represented by the conceptual framework which is verified and validated.

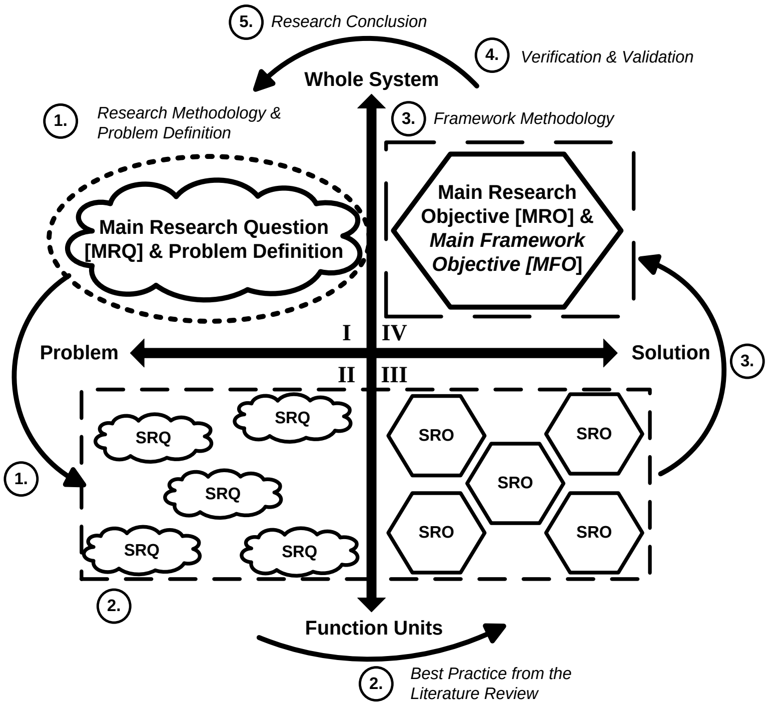


Figure 10.3: The Alignment of the Research Methodology within the Context of the Systems Engineering Approach

In Figure 10.4 below, the research methodology alignment and execution is also cross referenced with the different chapters in this research. It indicates the relationship between process and the respective chapters in this document which illustrate the research method and argument presented in this research.

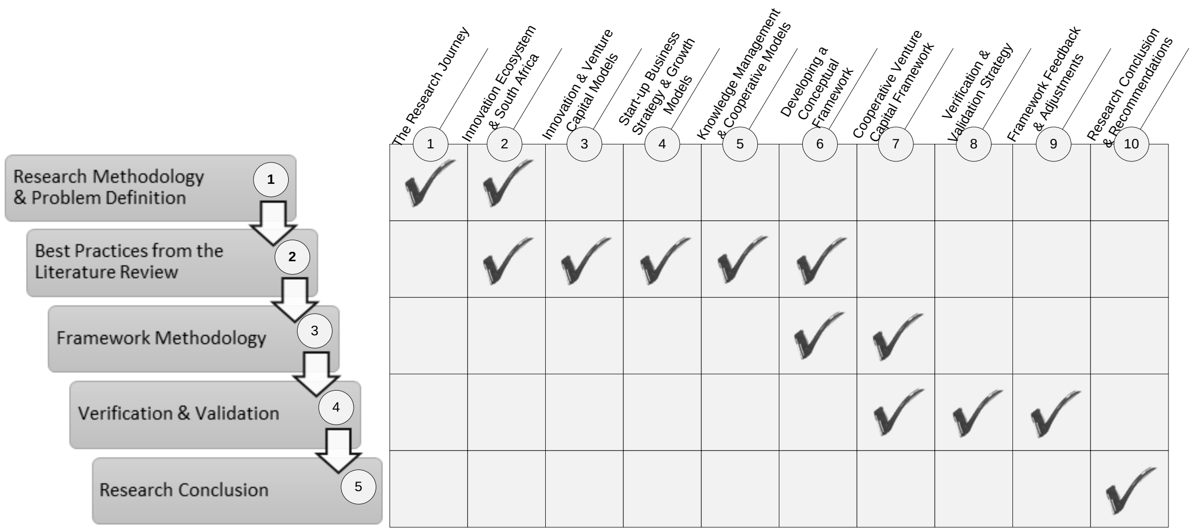


Figure 10.4: The Research Methodology Chapter Cross Reference

10.2.1.1. REFLECTION ON THE RESEARCH PROBLEM DEFINITION AND NEED

In Chapters 1 and 2, the problem of innovation inefficiency to support the needs and benefits of socio-economic development was addressed. The role of entrepreneurship and innovation in a modern society has become increasingly important to sustain global competitiveness that is achieved through establishing healthy innovation ecosystems. However, in order to create and sustain a healthy innovation ecosystem, an entrepreneurial and innovation pipeline is required to support continuous investments and an environment is required that is conducive to doing business and enabling businesses to overcome challenges. *So what entrepreneurial and innovation pipeline can be developed to support the value chain of commercialisation?*

10.2.1.2. REFLECTION ON THE LITERATURE REVIEW

It was important to develop an understanding of the present state of thinking in the research community on supporting and promoting entrepreneurship and innovation. The literature review documented covers a small portion of the extensive research performed in the respective domains, and it was focused on identifying and understanding the best practice models that support entrepreneurship and innovation. The fields of concern were identified through the preliminary literature review and the dissemination of the complex problem into sub-research questions. Note that some sub-research questions emerged during the literature review and were added, while others were added to reduce the scope of the research (refer to Table 1.1).

The fields of concern covered the domain areas such as innovation ecosystems, technology transfer models, innovation models, venture capital models, knowledge management models, cooperative models and start-up business strategy and growth models. Chapter 2 reviewed innovation ecosystem models, specifically focusing on the movement towards entrepreneurial universities and ecosystems, while technology transfer models were also evaluated. It also further discussed the problem definition of the valley of death and commercialising challenges, while also covering South Africa's innovation ecosystem for the framework application in the case study of the Stellenbosch University ecosystem.

Chapter 3 focused on evaluating the best practice models between innovation and venture capital models, with a specific focus on supporting entrepreneurship. Chapter 4 focused on start-up businesses with regards to challenges and entrepreneurial approaches while strategy and growth models were also evaluated. Chapter 5 reviewed knowledge management models, with a specific focus on integrated knowledge networks and innovation. It also focused on evaluating cooperative models, while the state of cooperatives in South Africa was also evaluated.

10.2.1.3. FRAMEWORK METHODOLOGY

The framework methodology consists of the process for developing the framework and the developed conceptual framework. The conclusions and reflections on the framework development methodology and the conceptual framework within the contexts of this research is discussed below.

10.2.1.3.1. REFLECTION ON THE FRAMEWORK DEVELOPMENT METHODOLOGY

The process of creating the framework is outlined in the framework development methodology in Chapter 6 and incorporates four high-level requirements, namely, the framework objectives, design criteria, process and functions, and enterprise engineering structural components (refer to Figure 6.2). The fields of concern from the literature review provided potential unit solutions which were used to formulate design criteria for the construction of the conceptual framework that can be considered as the nature of knowledge reconstruction. The objective of the conceptual framework is to represent the *'whole solution'* through integrating the unit solutions of the multiple domains with the objective of this research (refer to Figure 6.9).

The framework development methodology then facilitated the development of the conceptual framework called the Cooperative Venture Capital Framework (CVCF). The CVCF was developed because the collaborative nature of the cooperative model that supports entrepreneurial teams drives the commercialisation process. However, cooperatives struggle to raise capital. In order overcome the struggle to obtain financing for entrepreneurial team and the cooperative, the venture capital model was incorporate to incentivise investors to finance the innovation process. Therefore, the CVCF's organisation structure overcomes two challenges which is to provide a flexible vehicle to support the formation of entrepreneurial teams and provide financing to entrepreneurs, as well as the necessary innovation pipeline for investors to finance.

The process and functions of the CVCF were developed from the best practices of venture capital and cooperative models that were identified and discussed in Chapters 3 and 5 respectively. However, the CVCF is further supported by other unit solutions found in the literature, such as entrepreneurial approaches and commercialising challenges to start-up businesses, as discussed in Chapter 4. It also includes strategy and growth models that best support the development of entrepreneurial teams. In Chapter 2, the dynamics of the innovation value chain and shift towards entrepreneurship are unit solutions identified to support the CVCF. In Chapter 3, the unit solutions of innovation models also supports the CVCF in understanding the dynamics of the innovation process and the key to providing flexibility through removing unnecessary 'gate-keepers' and 'red-tape'. In Chapter 5, the dynamics of knowledge forming the basis for innovation, as well as the knowledge flow and integrated knowledge network models were identified to support the CVCF as unit solutions. In Table 7.6, a summary of the CVCF achieving the required design criteria is provided.

These unit solutions mentioned above were then formulated as design criteria for the CVCF, while the overall process of developing the framework used a black box systems engineering approach. The black box systems engineering approach is used to guide the CVCF application process and to enable specific components to be adapted to create a specific Cooperative Venture Capital Models (CVCMs) as output. The CVCF output produced was then verified through an enterprise engineering approach. The enterprise engineering approach is based on the enterprise engineering classification system by Dietz *et al.* (2013) and involves a specific methodology on the structural components required by the framework (refer to Figure 6.8). These structural components include enterprise processes and systems, human resource management and incentives, information and knowledge management processes, organisational structures, strategic initiatives management, and overall integration of complex systems and structures (refer to Table 6.9).

10.2.1.3.2. REFLECTION ON THE COOPERATIVE VENTURE CAPITAL FRAMEWORK

The framework development methodology used a black box systems engineering approach to guide the application of the CVCF. The systems engineering approach involved three components which included an input analysis, black box and output functions (refer to Figure 7.1). The input analysis consisted of an analysis of the purpose for developing the CVCM, analysing the CVCM for the necessary knowledge and human capital capacity (refer to Figure 6.3), and analysing the specific gaps and challenges within their specific ecosystem. The black box of the CVCF consists of two main components, namely, the organisation structure fit and the enterprise innovation process.

The CVCF organisation structure fit combines the venture capital and cooperative model (refer to Figure 7.2), as well as additional components such as strategic partnerships, general partnership and cooperative administration in a matrix format (refer to Figure 7.3). A typical venture capital platform model is used; that combines investment capital and support services to enable the entrepreneur teams' development. The additional components all support the additional support services aimed at reducing the cost of doing business and entrepreneur teams to overcome challenges. The cooperative model that best suits the CVCF is a combination of new generation cooperative models (refer to Figure 5.28). The secondary portfolio cooperatives are to form a capital seeking entity (outside equity not in the cooperative) using an investment fund or trust, while the primary cooperative is to form an investor-share cooperative (outside equity in the cooperative) which protects the investment of the secondary cooperative.

Notably, as the primary cooperative is established with the entrepreneurial team, no equity is distributed among members. In order to avoid unnecessary equity dilution, a term sheet agreement is structured whereby the expectation, roles and responsibilities, and outcomes of each member is documented. Once the value is created within the cooperative, and it is ready to scale or exit, the term sheet will come into play and valued on each member’s contribution to their equity stake. If members do not contribute they are structured under a shadow cooperative, while primary cooperatives that fail or do not perform are deregistered with a liquidation preference for the secondary cooperative investments.

The CVCF enterprise innovation process (refer to Figure 7.5) is rooted in four main principles that consists of start-up businesses growth and standardised financial roadmap; start-up businesses growth challenges and gaps (valley of death); business incubators support programmes; and CVCM management and executive’s role and high-level functions. The start-up business growth and standardised financial roadmap provides the CVCM with the understanding of when investments are needed by the primary cooperatives, while the entrepreneurial teams can develop capitalisation tables or financial roadmaps of their growth.

In the input analysis, specific growth challenges and gaps are identified, and the CVCM needs to make a strategic decision to provide the support services to help entrepreneurial teams overcome those challenges and gaps. The business incubator support programmes are standardised support services entrepreneurial teams generally require and can either be provided on demand or continuously and are dependent on the general partnerships established. The CVCM can also be themed for a specific industry whereby specialised support services are offered for that industry.

The role of the CVCM management and executives are either structured controlling the secondary or tertiary cooperative hierarchy levels and are responsible for setting up the CVCM structure including strategic and general partnerships, as well as the cooperative administration and knowledge management system (refer to Figure 7.4). These high-level functions also include the establishing of key performance indicators and applying benchmark standards in business incubators to the various departments of the CVCM.

The CVCF enterprise innovation process also includes the lean growth methodology (refer to Figure 4.8) created to support the entrepreneurial teams which combine the following three models from the literature:

- Lean start-up methodology developed by Eisenmann *et al*. (2011) and Ries (2011);
- Tipping points developed by Gladwell (2000) and Phelps *et al.* (2007);
- Absorption capacity developed by Cohen & Levinthal (1990) and Phelps *et al.* (2007).

The lean growth methodology together with other tools such as the strategic fit model, business model canvas and the experimental board are the support models and tools for entrepreneurial teams to grow their businesses through hypothesis-driven entrepreneurship. The fundamental essence is for entrepreneurial teams to test their business assumptions through a validated learning process, as well as internally aligning their resources to overcoming growth states enforced by the external environment. The lean growth methodology provides the flexibility for entrepreneurial teams to grow their businesses while also being integrated into the enterprise innovation process of the CVCF.

The final component of the framework's systems engineering approach is the enterprise functional output which includes the overall organisation structure and enterprise innovation process developed for the specific CVCM. It also includes the setting of key performance indicators for the various departments and for the CVCM management to benchmark the organisation. The benchmarking of the CVCM will be compared to other equity-based business incubators.

10.2.1.4. REFLECTION ON THE VERIFICATION AND VALIDATION STRATEGY

The research methodology utilises the literature and the constructivism theory to provide internal verification while interviews with industry experts provide external validation. The constructivism theory requires three distinct quality criteria to fulfil the verification and validation of the research. The quality criteria are comprised of trustworthiness, authenticity and misapprehensions (Guba & Lincoln, 1994).

The internal verification consists of two components. The first is the design criteria of the conceptual framework formulated from the extensive literature review. The literature sources provide trustworthiness, and the authenticity is created by new knowledge and understanding created through the accumulation and reconstruction of knowledge to formulate the CVCF. The second internal verification is the enterprise engineering methodology whereby the developed conceptual framework and model are required to verify application of the various enterprise engineering structural components (refer to Table 8.1). The enterprise engineering methodology was created based on the work by Dietz *et al.* (2013) which provides the trustworthiness in the literature sources, while authenticity is provided through reconstruction of the enterprise engineering classification system.

In order to provide an example of the practical application of the CVCF, a case study of the Stellenbosch University ecosystem was developed, and interviews were conducted with industry experts. The external validation consists of two sets of interviews. The first set of 13 structured interviews was with entrepreneurs, innovators and business developers in the LaunchLab, whereby specific challenges, gaps, support services and misapprehensions were identified. The structured interviews also played a vital role in verifying the findings from the literature with regards to challenges, gaps and support services (refer to Chapters 2 and 4). The trustworthiness of the interviewers is slightly limited with the majority of interviewees being young and inexperienced entrepreneurs and innovators, and the authenticity criteria are rooted in the alignment with the results from the literature. The role of the misapprehensions of the concept of cooperatives as legal business entities is also notable.

The second set of five semi-structured interviews were with business developers, management and executives at the LaunchLab and Innovus (Pty) Ltd of Stellenbosch University. The semi-structured interviews discussed the CVCF specifically seeking appraisal, critique and recommendations on the framework while the SUCVCM was used as an application example in conjunction with the CVCF. The interviewees all stress the need for an innovation pipeline, while all appraised the comprehensiveness and inclusivity of the CVCF. However, there is a misapprehension regarding the use and role of cooperatives in general among all the interviewees. The paradigm of cooperatives is mainly based on informal traditional cooperatives and the lack of applications of cooperatives as a legal business entity.

10.2.1.5. CONCLUDING REMARKS ON THE RESEARCH METHODOLOGY

In Figure 10.5, the research methodology and the main concluding outcomes derived from the research argument are illustrated. The conclusions, within the context of the research argument and methodology, are as follows:

- **Research Methodology and Problem Definition:** The research methodology is described in Chapter 1 while the problem defined for this research is described in Chapters 1 and 2. Within the context of the literature landscape and the research methodology, the following conclusions can be made:
  - The problem defined as start-up businesses overcoming internal and external challenges in order to commercialise intellectual property or technology.
  - It addresses the need for developing an innovation pipeline in order to benefit from its potential socio-economic impact.
  - The research methodology is developed using a systems engineering approach to guide the constructivism theory the research argument is based on.
- **Best Practice from the Literature Review:** The literature review discussed in Chapters 2 to 5 confirmed that:
  - The components that innovation ecosystems consist of and the movement towards an entrepreneurial ecosystem was identified as well as the importance of the innovation pipeline to overcome gaps or the valley of death (Chapter 2).
  - The components of the innovation and venture capital models were identified as design criteria for the CVCF enterprise innovation process (Chapter 3).
  - The organisation structure of the CVCF was also identified from the venture capital entity (Chapter 3).
  - The dynamics and challenges for start-up businesses that are needed to be overcome as identified for the design criteria for the CVCF (Chapter 4).
  - The strategy and growth models were considered as tools and the lean growth methodology was created (Chapter 4).
  - The components of the information and knowledge flow provided by integrated knowledge networks was identified as design criteria (Chapter 5).
  - The organisation structure components of cooperative models were identified as design criteria as well as challenges associated with cooperatives (Chapter 5).
- **Framework Methodology:** Once the literature was reviewed, the design criteria from best practices and gaps were identified, and the set of requirements for the framework methodology was formulated. The requirements formulated for the framework methodology consists of:
  - The design criteria requirements from the literature review (Chapters 2 to 5);
  - The outline of the framework development methodology (Chapter 6);
  - The application of the requirements in developing the CVCF (Chapter 7) and the CVCF was applied in the case study of Stellenbosch University ecosystem (Chapters 2, 4 and 7);

    - The enterprise engineering structural components act as a checklist for the output produced by the CVCF (Chapters 6 and 8).

- **Verification & Validation:** The requirements from the verification and validation process were to test the quality of its trustworthiness, authenticity and the new paradigm that was created (Chapter 8). This was achieved through the verification and validation process and includes:
    - The internal verification of the developed framework was achieved from the design criteria identified from the literature review and the requirements by the enterprise engineering structure components. The trustworthiness was attained through the literature sources used, while the authenticity and new paradigm were achieved by the CVCF developed.
    - The external validation was achieved through interviews with industry experts to validate the case study and subsequent literature findings, as well as the CVCF. The validation by industry experts provided additional trustworthiness of the framework produced.
    - Framework and case study adjusted from the recommendation and suggestions received from the external validation with industry experts. This adds to the authenticity of the research produced and identified any misapprehensions.

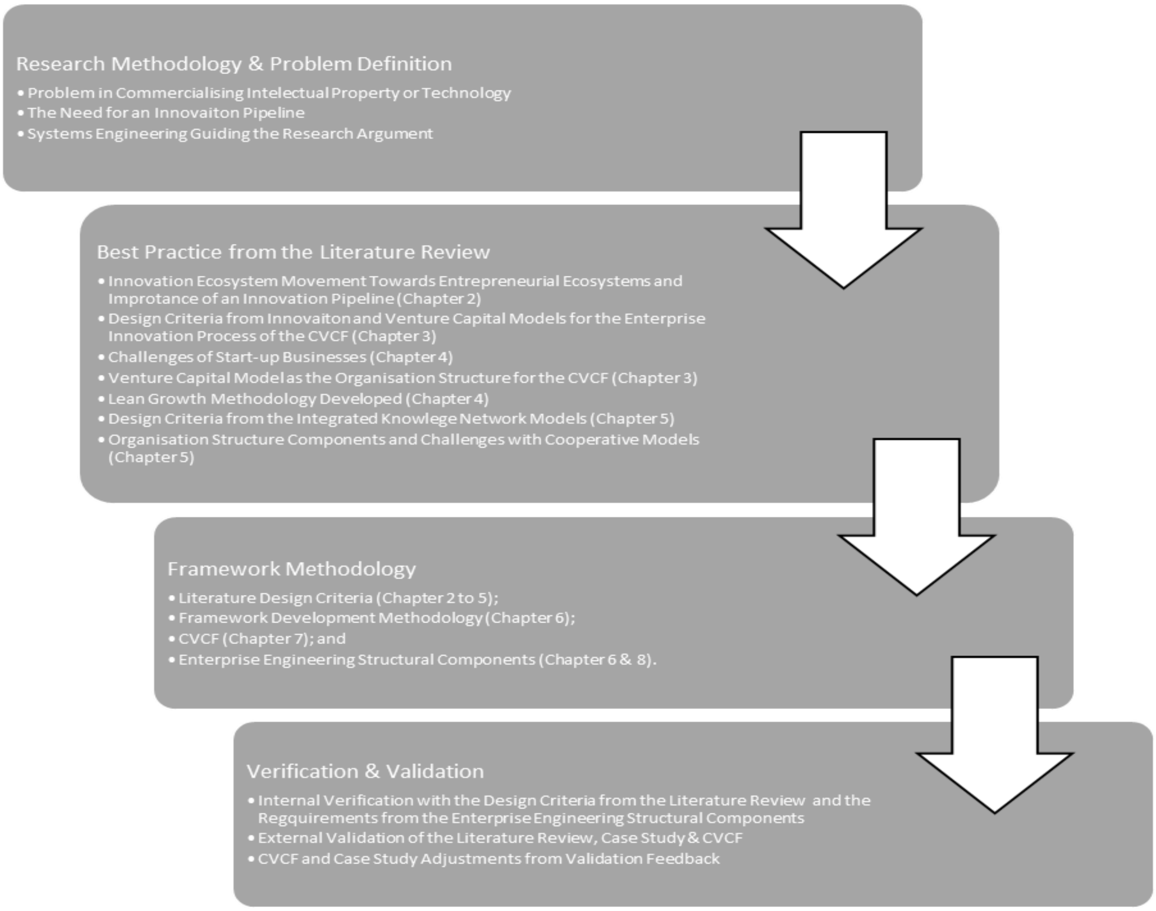


Figure 10.5: Conclusions within the Context of the Research Methodology

10.2.2. CONCLUSION OF RESEARCH METHODOLOGY

The research study developed a conceptual framework to support and promote an entrepreneurial and innovation pipeline that represents the 'whole solution' addressing the complex problem and need for an innovation pipeline. The research and framework development methodologies used the accumulated knowledge to develop an understanding that was validated with external interviews, while the reconstruction of knowledge created the conceptual framework.

The constructivism theory successfully supported the development of the conceptual framework with internal verification from the literature design criteria and enterprise engineering structural components. Furthermore, the external validation with industry experts supported the developed framework and provided additional recommendations and suggestions.

The research methodology has contributed significantly in creating new knowledge through the accumulation and reconstruction of knowledge that can be argued to be of a sound degree of quality. Therefore, the systems engineering approach has successfully developed the Cooperative Venture Capital Framework, which serves as an alternative solution that supports and promotes an entrepreneurial and innovation pipeline that specifically focuses on the value chain of commercialisation.

10.3. NOVELTY & SIGNIFICANCE

The novelty and significance of this research can be divided into four main concepts, namely, the lean growth methodology, the knowledge flow network, the enterprise engineering methodology, and the conceptual framework. The reflections on their novelty and significance is discussed in this section below.

10.3.1. REFLECTION ON THE LEAN GROWTH METHODOLOGY

The lean growth methodology developed in Chapter 4 is based on the literature by Cohen & Levinthal (1990) Gladwell (2000), Phelps *et al.* (2007), Eisenmann *et al*. (2011), and Ries (2011). The significance is the alignment between the models and the nature of reconstructing the models to produce the lean growth methodology. The lean growth methodology in essence, continuously validates different business assumptions while aligning the business's internal resources with the external environment. It allows a business to undergo different tipping points (stable/unstable) at different growth states requiring strategic decisions. The novelty of the lean growth methodology is its accumulation and reconstruction of existing knowledge to produce an authentic new support model for entrepreneurial teams.

10.3.2. REFLECTION ON THE KNOWLEDGE FLOW NETWORK MODEL

The knowledge flow network aligned the knowledge supply chain of commercialising intellectual property with the different business growth states/stages and associated role players, as well as integrated knowledge networks and knowledge management systems to support the CVCM. The knowledge flow network is essential in supporting the enterprise innovation network of the CVCM while providing the IT back-end platform to manage cooperative administration and knowledge management software. Additionally, catalyst collaborative projects can be utilised to incorporate knowledge networks in supporting the entrepreneurial team's development. The novelty of the knowledge flow network is in the integration and reconstruction of existing knowledge to produce an authentic and essential support element to the CVCF.

10.3.3.REFLECTION ON THE ENTERPRISE ENGINEERING METHODOLOGY

The enterprise engineering methodology is the reconstruction of the classification system for enterprise engineering, combined with business management practices to identify key structural components the enterprise engineering models require. The significance of this methodology is that it furthers the understanding and existing knowledge on the new emerging field of enterprise engineering. The novelty is in the unique structural components developed which the application of complete enterprise engineering techniques can be measured with.

10.3.4.REFLECTION ON THE COOPERATIVE VENTURE CAPITAL FRAMEWORK

The Cooperative Venture Capital Framework that combines the organisation structuring of cooperative and venture capital models. It also integrated other best practices from the literature and is verified by a unique enterprise engineering methodology. The CVCF provides an alternative solution to supporting and promoting entrepreneurship and innovation through a pipeline focusing on commercialisation. The significance of the CVCF is the potential socio-economic benefits to the country, region, community and organisation. The novelty is predominantly in the CVCF specialised cooperative financing model that focuses on supporting entrepreneurship and innovation.

10.4. FUTURE RESEARCH OPPORTUNITIES

In this research study, numerous future research opportunities have come to light. The future research opportunities can be categorised into two categories with regards to furthering the research of this study to a doctoral research study with relation to this research field in general.

The future research opportunities specifically related to furthering this research study include the following:

- Within the context of the CVCF, it is recognised that the current case study is limited to a certain sector, and that further validation in different industries, for example, corporate organisations, retention strategies and regional cluster development, will improve the robustness and reliability of the framework application.
- In the field of growth models, the growth states model has made significant progress to furthering the understanding of the dynamics surrounding business growth while the lean start-up methodology has revolutionised the entrepreneurial approach to growing a business. The lean growth methodology combines the synergies between the lean start-up and growth states models to further the knowledge

on business development. However, it is the conceptual model that can further benefit from a more robust conceptual model development process and an improved literature study specifically focusing on growth models.

- The field of enterprise engineering is a fairly new domain and is limited in literature that defines the discipline of enterprise engineering, as the literature predominantly focuses on the application in information and knowledge management systems. The enterprise engineering methodology can further be developed with regards to principles, structural components and measuring techniques. The objective will be to support the construction of the overall enterprise engineering discipline that is not limited to the sole application of subdisciplines, such as information systems and management.

The future research opportunities specifically related to this research field in general includes the following:

- The cooperative administration and knowledge management software can be further researched and developed to support the coordination and management of cooperatives. It is essential for large-scale cooperatives to manage and coordinate their members which increases in complexity as the cooperative scales. The industry currently provides cooperative administration and information management software, but applying knowledge management models and systems can further improve the application and impact of such software.
- The field of cooperative models and specifically the development of new generation cooperatives requires global standards in the legal application of the cooperatives. Benchmarking of these new generation cooperatives in terms of legislation for countries will provide cooperatives with a foundation to become globally more competitive as a legal entity.
- The tax deductions and benefits of different cooperative models on a national and global perspective in comparison with other company legal entities is a promising future research opportunity. Countries can further benefit from international benchmarks on incentivising cooperative development.

The general research opportunities that were identified during this research study include the following:

- The benchmarking of technology transfer offices in South Africa is lacking in empirical data and is a worthy future research opportunity. It can improve the country’s performance in overcoming bottlenecks and applying best international practices in transferring technology.
- The benchmarking of business incubators in South Africa and globally (except for the United States of America) is lacking in empirical data and is a worthy future research opportunity. The different business incubator models are not evaluated to determine best practices in business incubator models.
- There is limited research on the venture capital model and different venture capital platforms with regards to organisational structuring and processes. Benchmarking of the different venture capital models and platforms is also a promising future research opportunity.

10.5. FINAL CONCLUDING REMARKS

The field of entrepreneurship and innovation has been prominent in the past century, with increasingly more research produced in recent decades. The problem identified in the literature is the challenges found in commercialising intellectual property or technology. It is evident that both internal and external detriments influence the process and success of commercialisation. Therefore, the need for an innovation pipeline to support and promote entrepreneurship and innovation is crucial for attaining the impact and benefits for socio-economic development.

The interdependencies of entrepreneurship and innovation are essential for developing a competitive advantage to all organisations and regions, but requires enablers to succeed in effectively utilising it for socio-economic development. The Cooperative Venture Capital Framework (CVCF) provides a suitable conceptual solution to developing an innovation pipeline through fundamentally enabling entrepreneurship with a comprehensive support structure. The CVCF considers the strategic positioning to optimally provide sufficient support in a given environment while enabling entrepreneurship through providing funding and support services essential for overcoming commercialising challenges. The CVCF considers the value proposition for investors, partnerships and entrepreneurial teams to benefit mutually in collaboration.

The utilising of the cooperative and venture capital models together with multiple other solutions interdependently enables the creation of a new paradigm in thinking. This is crucial in addressing the complex problem of commercialising intellectual property or technology for socio-economic impact.

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APPENDIX A

APPENDIX A1: PRIVATE COLLEGES & UNIVERSITIES IN SOUTH AFRICA

Table A.1: List of Private Colleges and Universities in South Africa[127] that are Accredited as Degree Granting Institutions

Institution	Location(s)	Website	Est.	Type
Auckland Park Theology Seminary	Johannesburg	www.afmtc.org	2008	Theology Seminary
Baptist Theological College of Southern Africa	Johannesburg	www.btc.co.za	1951	Theology Seminary
Boston City Campus and Business College	Multiple	www.boston.co.za	1992	College
Cape Town Baptist Seminary	Cape Town	www.ctbs.org.za	1993	Theology Seminary
Centre for Creative Education	Cape Town	www.cfce.org.za	1993	College
College of the Transfiguration	Grahamstown	www.cott.co.za	1993	Theology Seminary
Cornerstone Institute	Cape Town	www.cornerstone.ac .za	1970	University
Cranefield College	Pretoria	www.cranefield.ac.za	1997	College
CTI Education Group	Johannesburg	www.cti.co.za	1979	College
Damelin	Multiple	www.damelin.co.za	1943	College
Da Vinci Institute for Technology Management	Johannesburg	www.davinci.ac.za	1992	University
Doxa Deo School of Divinity	Multiple	www.doxadeo.co.za	-	Theology Seminary
Embury Institute for Teacher Education	Durban	www.eite.ac.za	2005	University
George Whitefield College	Cape Town	www.gwc.ac.za	1989	Theology Seminary
Greenside College of Design	Johannesburg	www.designcenter.c o.za	1987	College
Hebron Theological College	Benoni	www.hebroncollege. co.za	2000	Theology Seminary
Helderberg College	Somerset West	www.hbc.ac.za	2001	College
Independent Institution of Education[128]	Multiple	www.iie.ac.za	1993	University
IMM Graduate School of Marketing	Johannesburg	www.imm.co.za	1997	College
Inscape Design College	Multiple	www.inscape.co.za	1981	College

[127] The ranking of South African universities is well summarised in the following online article:
Wikipedia, 2014. *Ranking of Universities in South Africa.* [Online] Available at http://en.wikipedia.org/wiki/Rankings_of_universities_in_South_Africa [Accessed 20 April 2014].
[128] The Independent Institution of Education is the conglomerate entity for the following education centres Vega, Varsity College, Rosebank College, Design School Southern Africa (DSSA), Forbes Lever Baker and including Distant Learning.

Institution	Location(s)	Website	Est.	Type
International College of Bible and Missions	Roodepoort	www.icbm.ac.za	2005	Theology Seminary
Management College of Southern Africa	Durban	www.mancosa.co.za	1995	College
Midrand Graduate Institute	Midrand	www.mgi.ac.za	1989	University
Monash South Africa	Johannesburg	www.monash.ac.za	2001	University
Mukhanyo Theological College	Multiple	www.mukhanyo.co.za	1985	Theology Seminary
Nazarene Theological College	Johannesburg	www.nazarene.co.za	2001	Theology Seminary
Oval Education International	Multiple	www.myoval.co.za	1989	College
PC Training and Business College	Durban	www.gopctraining.co.za	2008	College
Prestige Academy	Bellville	www.prestigeacademy.co.za	2001	College
Qualitas Career Academy	Multiple	www.qualitasworld.co.za	2008	College
South African College of Applied Psychology	Kenilworth	www.sacap.edu.za	2005	College
South African Theological Seminary	Johannesburg	www.sats.edu.za	1996	Theology Seminary
St Augustine College of South Africa	Johannesburg	www.staugustine.ac.za	1999	College
St Joseph's Theological Institute	Johannesburg	www.sjti.ac.za	2003	Theology Seminary
Stellenbosch Academy of Design and Photography	Stellenbosch	www.stellenboschacademy.co.za	2004	College
Stenden University South Africa	Port Alfred	www.stenden.ac.za	2002	University
The South African School for Motion Picture Medium and Live Performance (AFDA)	Johannesburg, Cape Town	www.afda.co.za	1994	College
The Open Window School of Visual Communication (TOW)	Pretoria	www.openwindow.co.za	1989	College

APPENDIX A2: BUSINESS SCHOOLS IN SOUTH AFRICA

Table A.2: List of Business Schools in South Africa

Institution	Location(s)	Website	Est.	Accreditation	Association
CIDA City Campus	Johannesburg	www.cidacitycampus.co.za	2000	CHE	-
Gordon Institute of Business Science	Johannesburg	www.gibs.co.za	2000	CHE, AMBA (MBA & DBA)	University of Pretoria
Graduate School of Business	Durban	www.gsbl.ukzn.ac.za	1974	CHE	University of KwaZulu-Natal
Henley Management College	Johannesburg	www.henleysa.ac.za	1992	CHE, AMBA (MBA), EQUIS, AACSB	-
Management College of Southern Africa	Durban	www.mancosa.co.za	1995	CHE	-
Milpark Business School	Multiple	www.milpark.ac.za	1997	CHE	-
NMMU Business School	Port Elizabeth	www.mba.nmmu.ac.za	2005	CHE	NMMU
Graduate School of Business and Government Leadership	Mafikeng	www.nwu.ac.za	2000	CHE	North-West University
Potchefstroom Business School	Potchefstroom	www.pbs.nwu.ac.za	1998	CHE	North-West University
Regenesys Business School	Johannesburg	www.regenesys.co.za	1999	CHE	-
Regent Business School	Johannesburg	www.regent.ac.za	2000	CHE	-
Rhodes Business School (RBS)	Grahamstown	www.ru.ac.za	2000	CHE, AMBA (MBA) (in process)	Rhodes University
Southern Business School	Johannesburg	www.sbs.ac.za	1996	CHE	-
South African College of Business (SACOB)	Cape Town	www.sacob.com	2011	Umalusi (in process),CHE (in process)	-
School of Business Leadership (SBL)	Midrand	www.unisa.ac.za	1965	CHE	University of South Africa
Tshwane University of Technology Business School	Pretoria	www.tut.ac.za	1999	CHE	Tshwane University of Technology
Turfloop Graduate School of Leadership	Polokwane	www.ul.ac.za	1997	CHE	University of Limpopo
UCT Graduate School of Business (GSB)	Cape Town	www.gsb.uct.ac.za	1964	CHE, AMBA (MBA), EQUIS, AACSB	University of Cape Town

Institution	Location(s)	Website	Est.	Accreditation	Association
University of Stellenbosch Business School (USB)	Bellville	www.usb.ac.za.	1964	CHE, AMBA (MBA), EQUIS, AACSB	Stellenbosch University
University of the Free State Business School	Bloemfontein	www.bus.ufs.ac.za	1999	CHE	University of the Free State
Varsity College School of Business and Technology (VC SoBT)	Multiple	www.varsitycollege.co.za	1991	CHE (conditional)	Independent Institute of Education
Faculty of Economic and Financial Sciences	Johannesburg	www.uj.ac.za	1989	CHE	University of Johannesburg
Wits Business School (WBS)	Johannesburg	www.wbs.ac.za	1968	CHE, AMBA (MBA)	University of the Witwatersrand

APPENDIX A3: OTHER RESEARCH INSTITUTIONS AND COUNCILS IN SOUTH AFRICA

Table A.3: List of Research Institutions and Councils[129] in South Africa

Institution	Location(s)	Mandate	Website	Est.
Agricultural Research Council	Multiple	Principal agricultural research institution in South Africa so as to conduct research, drive research and development, drive technology development and the transfer (dissemination) of information in order to: • Promote agriculture and related industries; • Contribute to a better quality of life; • Facilitate/ensure natural resource conservation; • Alleviate poverty.	www.arc.agric.za	1990
Medical Research Council: Strategic Health Innovation Partnerships	Cape Town	The mission of SHIP is to bring life-saving drugs, vaccines and medical devices to market by acting as a catalyst in the product development of new innovative interventions. • Act as a funding agency for leading multidisciplinary projects. • MRC funds the infrastructure and salaries • Actively manage and coordinate health innovation in South Africa within the strategic disease and technology focus areas. • Provide strategic and scientific leadership • Seek to augment gaps in the innovation pipeline by leveraging non-financial resources • Use funds flexibly between disease focus areas based on project needs. • Ensure that SHIP research is globally aligned and competitive through collaboration with other PDPs, such as MMV, AERAS etc.	www.innovation.mrc.ac.za	2013
Council for Scientific and Industrial Research	Stellenbosch and Pretoria	CSIR's mandate is to improve the quality of life of the South African people by contributing to economic growth, create jobs and promote environmental sustainability. This is achieved through the following activities: • transfer of technology, • knowledge, skills and people.	www.techtransfer.csir.co.za or www.csir.coza	1945
Human Sciences Research Council	Multiple	The core business of the Human Sciences Research Council (HSRC) is to conduct large-scale, policy-relevant, social-scientific projects for public-sector users, non-governmental organisations and international development agencies. The focus research areas and programmes are as follows: • Centre for Science, Technology and Innovation Indicators; • Democracy, Governance and Service Delivery;	www.hsrc.ac.za	

[129] SARIMA, (2014). *Porfolios: Innovation and Technology Transfer*. [Online] Available at http://sarima.co.za/portfolios/innovation-and-technology-transfer/resources.html#resource_satto [Accessed 30 April 2014]

Institution	Location(s)	Mandate	Website	Est.
		• Economic Performance and Development; • Education and Skills Development; • HIV/AIDS, STIs and TB (including the Africa-wide research network SAHARA); • Human and Social Development; • Population Health, Health Systems and Innovation.		
Water Research Commission	Pretoria	The WRC's mandate in summary includes the following: • An integrated approach to meeting South Africa's societal and water-sector R&D needs; • Provision of integrated solutions to invariably complex, inter-disciplinary problems; • Ongoing strategic identification of needs (short, medium and long-term needs, both explicit and implicit); and • Investment in knowledge creation, transfer and dissemination in a set of 5 Key Strategic Areas (KSAs).	www.wrc.org.za	
Council for Mineral Technology	Randburg	To serve the national interest through research, development and technology transfer, to promote mineral technology and to foster the establishment and expansion of industries in the field of minerals and products derived therefrom. They key objectives are: • Develop efficient mineral processing technologies and sustainable value added products and services; • Second economy interventions; • Human and organisational development; • Good governance.	www.mintek.co.za	2011
South African Bureau of Standards	Multiple	The SABS is a statutory body that was established in terms of the Standards Act 24 of 1945 and continues to operate in terms of the latest edition of the Standards Act 8 of 2008 as the national standardisation institution in South Africa to: • Develop, promote and maintain South African National Standards (SANS); • Promote quality in connection with commodities, products and services; • Render conformity assessment services and assist in matters connected therewith.	www.sabs.co.za	2008
Council for Geosciences	Multiple	The objectives of the CGS are to produce geoscience knowledge and provide geoscience-related services to the South Africa. In its mandate is the following: • Systematic documenting of South African geology and production of geoscience knowledge. • Provide commercial geoscience services and products to South Africa and internationally.	www.geoscience.org.za	2003

Institution	Location(s)	Mandate	Website	Est.
National Research Foundation	Pretoria	The NRF receives its mandate from the National Research Foundation Act 23 of 1998. According to Section 3 of the Act, the objective of the NRF is to: • Promote and support research through funding, human resource development and the provision of the necessary facilities in order; • To facilitate the creation of knowledge, innovation and development in all fields of research, including indigenous knowledge; • Contribute to the improvement of the quality of life of all the people.	www.nrf.ac.za	1998
South African Nuclear Energy Corporation	Pretoria	In terms of Section 13 of the Nuclear Energy Act 46 of 1999, the South African Nuclear Energy Corporation SOC Limited (Necsa) is mandated to: • Undertake and promote research and development (R&D) in the field of nuclear energy and radiation sciences and technology and, subject to the Safeguards Agreement, to make these generally available; • Process source material, special nuclear material and restricted material and to reprocess and enrich source material and nuclear material; • Cooperate with any person or institution in matters falling within these functions, subject to the approval of the Minister.	www.necsa.co.za	1999

APPENDIX B

APPENDIX B1: ENTREPRENEUR TYPES

Table B.1: Characteristics of Different Entrepreneur Types adapted from Diaz-Foncea & Marcuello (2013)

Entrepre-neur Type	Definition	Principal Roles*	Problem Solving	Sectors	Principal Organisational Structure Form
Serial	Serial entrepreneurs thrive on the excitement of starting a business from scratch, taking an idea to market and making it happen. They have sold or closed their original business, but at a later date have inherited, established and/or purchased another business. (Welsch, 2010)	All (1) to (12) depending on field and nature of problem solving.	Solving of technological problems and addressing market needs through value proposition created. Scalability is essential to gain capitalistic aspirations.	All sectors and markets.	Entrepreneurial start-up business.
Team	Two or more individuals who have a significant financial interest and participate actively in the development of the enterprise (Kamm, et al., 1990).	(2) Financial capital supplier (4) Decision-maker; (6) Manager; (7) Coordinator of economic resources; (12) Allocator of resources (Kamm, et al., 1990).	Problems of size and scalability (Cooper & Bruno, 1977).	High technology (Kamm, et al., 1990) and top management teams in other industrial and service sectors (Vyakarnam & Handdelberg, 2005).	Conventional firms, principally from an intra-firm perspective. Husband and wife enterprises, family related organisations, partner societies and short-term partner entities (Cachon, 1990).
Collective	A form of rent-seeking behaviour exhibited by formal groups of individual agricultural producers that combine the institutional frameworks of investor-driven shareholder and	(1) Risk-bearing; (3) Innovator; (5) Industrial leader;	Problem of non-rivalry or non-excludability of their products, problems affected by asymmetric information between	Farmers (as owners) or managers, or both, in the agricultural sector; on the board of	Producer-owned firms: agricultural cooperatives, marketing cooperatives (Cook & Plunkett, 2006), family-owned, ethnic

Entrepre-neur Type	Definition	Principal Roles*	Problem Solving	Sectors	Principal Organisational Structure Form
	patron-driven forms of collective action (Cook & Plunkett, 2006), making decisions concerning the deployment of assets using the combined judgement of the group (Bijman & Doorneweert, 2011).	(7) Coordinator of economic resources (Cook & Plunkett, 2006).	providers and customers, or both (Cook & Plunkett, 2006).	directors in other organizations (broad view).	entrepreneurship; as well as other inter-firm relations: network and alliances, cluster and industrial districts, and franchises (Burress & Cook, 2009).
Non-profit	A person who chooses the non-for-profit legal form for the firm to reduce the incentives to exploit consumers (Glaeser & Shleifer, 2001) and to provide public goods voluntarily (Bilodeau & Slivinski, 1996).	(1) Risk-bearing (Bilodeau & Slivinski, 1996); (2) Ideological actor (Rose-Ackerman, 1997); (3) Social preference and reputation-trend background (Glaeser & Shleifer, 2001).	Problems of ex post expropriation of consumers, employees, or donors (Glaeser & Shleifer, 2001).	Child care, long-term care facilities, hospitals, schools, performing arts (Glaeser & Shleifer, 2001); Savings and loan mutual (Hansmann, 1996); and Nursing home industry (Rose-Ackerman, 1997).	Not-for-profit organisations (associations and foundations).
Social	Persons as change agents in the social sector who adopt a mission to create and sustain social-, not just private-, value. Relentlessly pursuing new opportunities to serve that mission, engaging in continuous innovation, adaptation and learning, acting boldly without being unduly limited by current resources; exhibiting heightened accountability to those served and for the resulting outcomes. (Diaz-Foncea & Marcuello, 2013)	(3) Innovator; (5) Industrial leader (Austin, et al., 2006); (7) Coordinator of economic resources; (8) Owner of the enterprise; (12) Allocator of resources (Mair & Marti, 2006).	Look for the most effective methods of serving their social mission, helping to find new avenues for social improvement addressing the social need.	Broad economic sectors (Austin, et al., 2006), but mainly on social integration activities, recycling and other ecological and social services (Spear & Bidet, 2003; Toledano, 2011).	Work Integration Social Enterprises, Social-coops, other Social Economy Enterprises as well as some hybrid organisations.
Coopera-tive	A group who manage the venture creation process, take risk, and make judgmental decisions to create a business in a participatory way with	(1) Risk-bearing; (4) Decision-maker;	Reduction of labour, supply or purchase transaction costs (Hansmann, 1996);	Agricultural, manufacturing, construction, and service sectors	Worker, supplier, and consumer cooperatives

Entrepre-neur Type	Definition	Principal Roles*	Problem Solving	Sectors	Principal Organisational Structure Form
	the objective of obtaining mutual benefit to be distributed with equity among them (Diaz-Foncea & Marcuello, 2013).	(8) Owner of the enterprise (Rey & Tirole, 2000); (10) Contractor (Hansmann, 1996).	Creation of market value (Cook & Plunkett, 2006); Obtaining of market entrance and creation of market (countervailing) power (Hansmann, 1996); and Local anchoring of ownership and control (Melian & Campos, 2010).		

Note: ***Hebert & Link (1989) have identified 12 themes in the economic literature about entrepreneurial roles: 1) risk-bearing role associated with uncertainty; 2) supplier of financial capital; 3) innovator; 4) decision-maker; 5) industrial leader; 6) manager or superintendent; 7) coordinator of economic resources; 8) owner of an enterprise; 9) employer of production factors; 10) contractor; 11) arbitrageur; and 12) allocator of resources among alternative uses.**

APPENDIX C

APPENDIX C1: DATA FROM THE INTERVIEWS WITH ENTREPRENEURS, INNOVATORS & BUSINESS DEVELOPERS

Table C.1: Data from the Interviews with Entrepreneurs, Innovators & Business Developers

Data from the Interviews with Entrepreneurs, Innovators & Business Developers					
Number of Interviewees				13	
Number of Start-up Businesses				10	
Most Dominant Position of Interviewees				CEO & Founder	
Industry Sector of Start-up Businesses					
E-Commerce & IT				4	
Consultancy				3	
Marketing & Media				2	
Services				1	
Stages/States of Start-up Businesses					
Research/Ideation				1	
Pre-Seed				1	
Seed				4	
Early				3	
Later				1	
Relationship to the University of Stellenbosch					
LaunchLab Business Incubator				7	
Spin-off Business				1	
Owned by Stellenbosch University				2	
Financing Sources of LaunchLab Start-up/Spin-off Businesses					
			Current Financing	**Future Financing**	
Owners Capital			5	2	
Friends, Family and Fools			2	2	
Government Funding			2	0	
Angel Investment			4	4	
Venture Capital Investment			2	4	
Bank Debt Financing			0	1	
Private Equity Financing			0	2	
Stock Markets			0	0	
Crowdfunding			0	0	
Other: Industry Sponsorships			1	0	
None: Not Seeking			0	1	
Start-up Business Challenges	**Gen.**	**1st**	**2nd**	**3rd**	**Overall**
Stakeholder's Equity Management	5	2	0	0	7
Obtaining Financing	6	0	2	1	9
Financial Management (Cashflow, Breakeven, Profitability)	5	0	1	1	7
Finding Qualified Employees	5	0	1	1	7

Finding Unqualified Employees	1	0	0	0	1
People Management and Retaining Employees	1	0	0	0	1
Market Entry and New Markets	8	1	2	2	13
Customer Acquisition	9	5	0	1	15
Early Adopters	5	1	0	1	7
Distribution Channels	5	0	0	1	6
Operational Improvement	3	0	1	1	5
Developing New Products and/or Services	4	1	1	2	8
Increased Costs of Materials/Energy/Healthcare	2	1	0	0	3
Formulating and Implementing Formal Systems	5	1	2	1	9
Strategy Formulation and Implementation	4	1	2	0	7
Market Competition	2	0	1	0	3
Economy/Changing Conditions (Political, Legislation)	2	0	0	1	3
Other:					
Finding suitable partners	1				1
Communicating business vision	1				1
Start-up Business Support Services	**Gen.**	**1st**	**2nd**	**3rd**	**Overall**
Finding Entrepreneurial Team Members	8	1	2	2	13
Business Basics & Etiquette Workshops	5	0	0	2	7
Ideation Workshops	4	0	0	0	4
Office Space	8	0	0	2	10
High-Speed Internet	9	0	1	1	11
Intellectual Property Management	7	0	0	0	7
Prototyping & New Product Development	5	1	2	0	8
Contract Management	6	0	1	2	9
Coaching, Mentoring & Advisory Board Members	10	7	1	1	19
Management & Talent Acquisition	4	0	1	0	5
Design, Branding & Marketing Services	5	1	0	1	7
Accounting/Financial & Legal Services	7	1	1	0	9
Technology Commercialisation Assistance	5	0	0	0	5
Early Adopters & Customer Acquisition	6	2	1	1	10
Grants/Loan Funding Application	4	0	0	0	4
Investor Networks	7	0	3	1	11
In South Africa's start-up ecosystem, are there any major growth gaps (valley of deaths) due to lack of support?					
Within a university structure most ideas that have commercial potential, are too early stage but have to be protected/patented to enable researchers to publish. As such the technologies are rarely market ready, and the gap is in finding the resources to take the technology to that phase.					
A mature VC industry in lacking and this needs government to seed the industry much the way Israel did. Business start-up red tape reduction would also help.					
Lack of VC funding and lack of big companies to exit are huge valleys of death. Too many companies are not progressing to sustainable businesses and this will cause a bubble that might burst and make investment even harder to find.					
I believe there is a culture of not seeing the bigger picture and a lack of people willing to take risks.					
I'm not sure					
Yes, regulations and big players make it close to impossible to play ball with them.					

Foreign Investment is still a big problem in South Africa and could highly be appointed to the lack of start-up "success stories" in our country. With the help of foreign investment; start-ups in South Africa will have greater opportunities to scale and grow faster, something that is not possible at this stage. Thus, funding available within is South Africa is little.
I feel that is start-ups are resourceful enough they will recognise the assistance that is available. Many people have ideas but have not come across structures such as LL that allow for growth.
South Africa definitely has major growth debts but not because of lack of support but rather because of lack of information. The growth gaps are as a result of people who are not informed and don't make much effort to be informed.
Lack of quality mentorship; Lack of operational, strategy execution and scaling expertise; Lack of follow on funding after seed; Lack of risk appetite for global opportunities.
Yes. The gap between lab prototypes and market ready product
Absolutely, some of the biggest gaps are qualified and competent entrepreneurs with the right idea for their personality and passions. Some other gaps are seed funders are not easily found in public domain. There is thus a gap where feasible business ideas do not get the seed funding they require and therefore only remain ideas.
Not to my mind.
What is your perspective on cooperatives as legal entities? Would you consider joining an entrepreneurial team in a cooperative?
Not sure.
Not aware of legal implications
Not sure. Start-ups are in a state of chaos. So I think partnerships should be formed with more mature companies because they are more stable. This will give more stability to the legal entity. But most stable entities doesn't want to partner with start-ups because this destabilises them. So it is a catch 22.
I don't see a problem with it as long as every member knows what the expectation is.
As far as I understand it is risky and not flexible in terms of shareholding. I would rather consider other structures first. I would have to be convinced that a cooperative of the circumstances under which a cooperative is beneficial.
Yes
I think it is a great idea. It will help start-ups to grow their resource pools, which may give them a greater footprint in their respective sectors.
Yes as long as the value and vision is aligned I feel that the collaboration is valuable.
Unity is always a powerful tool in which if members function as one can truly be a great game changer. However i for one wouldn't join an entrepreneurial team in a cooperative unless we all had the same vision. I believe that to achieve any goal leadership will always be needed to maintain proper structure and where there is leadership then there submission is required.
I have no problem with the idea in theory but I think it would be difficult to pull this off in the real world.
Not sure.
I believe that cooperatives work in South Africa when you have buy-in from the stakeholders of the entity and they see the long term benefits. I would consider joining an entrepreneurial team in a co-op if I know the values, moral fibre and integrity of the members. Trust is the commodity and that is not easily gained. That will be the deciding factor for me.
Possibly. I would need to know more.